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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 4
FEBRUARY 15, 1980

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

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The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

PORTABLE WATER SAMPLING APPARATUS,
UOP Inc., Des Plaines, IL. (Assignee).
E. N. Colburn.
U.S. Patent No 4,160,622, 4 p, 3 Fig, 10 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 380, July 10, 1979.

Descriptors: *Patents, *Sampling, *On-site tests, Water wells, Water pollution, Equipment, Portable equipment.

A portable, self-powered water pumping apparatus for use in sampling water in remotely located wells comprises a pair of integrally connected, side-by-side, long flexible plastic tubes which may be wound around a reel which is preferably mounted for rotation on a mobile cart and which can be manually moved. When the lower ends of the tubes are well submerged beneath the water level in a well, admission of gas to the smaller tube at its upper end will force water which enters the larger tubing in the annular space surrounding the metal tubing up through the larger tube and out the upper end so that it can be collected. To facilitate the insertion of the extruded tubing into a well from the coil in which it is stored, the tubing is formed of a plastic such as a vinyl and acetate modified polyethylene which has a memory and which is flexible at low temperatures. (Sinha-OEIS)
W80-01479

CHEMICAL ANALYSES OF SURFACE WATER IN ILLINOIS, 1975-77, VOLUME I, DES PLAINES RIVER BASIN AND LAKE MICHIGAN,
Geological Survey, Champaign, IL. Water Resources Div.
D. Grason, and R. W. Healy.
Available from National Technical Information Service, Springfield, VA 22161 as PB-299 912, Price codes: A10 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-23, 1979, 218 p, 1 Fig, 5 Tab, 3 Ref.

Descriptors: *Illinois, *Water quality, *Surface waters, *Chemical analysis, *Water temperature, Sampling, Sites, Water analysis, Streamflow, Flow rates, Lake Michigan, *Des Plaines River basin(IL).

Samples of surface water were collected and analyzed by the Illinois Environmental Protection Agency. The results from water years 1975 to 1977 are presented in three volumes. The history of sampling and analytical methods used during that period are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made. Volume I includes the Des Plaines River basin and Lake Michigan. (Woodard-USGS)
W80-01584

CHEMICAL ANALYSES OF SURFACE WATER IN ILLINOIS, 1975-77, VOLUME II, ILLINOIS RIVER BASIN AND MISSISSIPPI RIVER TRIBUTARIES NORTH OF ILLINOIS RIVER BASIN,
Geological Survey, Champaign, IL. Water Resources Div.
D. Grason, and R. W. Healy.
Available from National Technical Information Service, Springfield, VA 22161 as PB-299 913, Price codes: A13 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-24, 1979. 282 p, 1 Fig, 5 Tab, 3 Ref.

Descriptors: *Illinois, *Water quality, *Surface waters, *Chemical analysis, *Water temperature, Sampling, Sites, Water analysis, Streamflow, Flow rates, *Illinois River basin, *Mississippi River tributaries north of Illinois River basin.

Samples of surface water were collected and analyzed by the Illinois Environmental Protection Agency. The results from water years 1975 to 1977 are presented in three volumes. The history of sampling and analytical methods used during that period are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made. Volume II includes the Illinois River basin and Mississippi River tributaries north of Illinois River basin. (Woodard-USGS)
W80-01585

CHEMICAL ANALYSES OF SURFACE WATER IN ILLINOIS, 1975-77, VOLUME III, OHIO RIVER TRIBUTARIES AND MISSISSIPPI RIVER TRIBUTARIES SOUTH OF ILLINOIS RIVER BASIN,
Geological Survey, Champaign, IL. Water Resources Div.
D. Grason, and R. W. Healy.
Available from National Technical Information Service, Springfield, VA 22121 as PB-299 914, Price codes: A11 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-25, 1979. 242 p, 1 Fig, 5 Tab, 3 Ref.

Descriptors: *Illinois, *Water quality, *Surface waters, *Chemical analysis, *Water temperature, Sampling, Sites, Water analysis, Streamflow, Flow rates, *Ohio River tributaries south of Illinois River basin, *Mississippi River tributaries south of Illinois River basin.

Samples of surface water were collected and analyzed by the Illinois Environmental Protection Agency. The results from water years 1975 to 1977 are presented in three volumes. The history of sampling and analytical methods used during that period are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made. Volume III includes Ohio River tributaries and Mississippi River tributaries south of Illinois River basin. (Woodard-USGS)
W80-01586

1B. Aqueous Solutions and Suspensions

DISSOLUTION KINETICS OF SILICATE ROCKS--APPLICATION TO SOLUTE MODELING,
Geological Survey, Denver, CO. WAter Resources Div.
A. F. White, and H. C. Claassen.
In: Chemical Modeling in Aquious Systems, Speciation, Sorption, Solubility, and Kinetics; ACS Sympsoium Series 93: American Chemical Society, Washington, District of Columbia, p 447-473, 1979. 10 Fig, 3 Tab, 32 Ref.

Descriptors: *Water chemistry, *Solubility, *Rocks, *Silicates, *Geochemistry, Groundwater, Reviews, Evaluation, Speciation, Sorption, Kinetics, Hydrogen ion concentration, Ion transport, Diffusion, Adsorption, Chemical reactions, Dissolved solids, *Chemical modeling, *Dissolution, Diffusion coefficient.

Silicate minerals comprise more than 75 percent of the rocks with which ground water comes in contact. Quantitative knowledge of the weathering rates of these minerals could provide an importan means of estimating the total residence time a water has been in contact with a given silicate rock, the effective surface area of the aquifer, and other information pertinent in defining a given hydrogeologic system. Workers have experimented to define the dissolution rates of silicate minerals. This paper briefly reviews the types of reaction rates that have been observed, followed by more detailed discussion concerning the dependence of these rates on constituents in the aqueous media, and the implications for solute modeling. (Woodard-USGS)
W80-01600

2. WATER CYCLE

2A. General

EFFECTS OF SUBURBAN CONSTRUCTION ON RUNOFF CONTRIBUTING ZONES IN A SMALL SOUTHERN ONTARIO DRAINAGE BASIN,
Trent Univ., Peterborough (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W80-01272

PROBABILITY ANALYSIS OF HISTORICAL FLOOD DATA,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-01279

THE RESULTS OF TEN YEARS' EXPERIMENTAL STUDY ON PLYNLIMON, MID-WALES, AND THEIR IMPORTANCE FOR THE WATER INDUSTRY,
Institute of Hydrology, Wallingford (England).
M. D. Newson.
Journal of the Institution of Water Engineers and Scientists, Vol 33, No 4, p 321-333, July 1979. 3 Fig, 3 Tab, 28 Ref.

Descriptors: *Demonstration watersheds, *Water yield, *Land use, *Water balance, On-site investigations, Watersheds(Basins), Forests, Grasslands, Hydrological cycle, Hydrology, Precipitation(Atmospheric), Streamflow, Instrumentation, Water loss, Evapotranspiration, Runoff, Water quality, Foreign research, *Plynlimon(Wales).

The initial objectives of the study were to determine: (1) whether annual water yields from catchments under forest and hill pasture differed; and (2) whether afforestation affected the timing and magnitude of flood flows. Provisional results from the Institute's Coal Burn catchment, in Cumbria, indicated that peak flows are increased by drainage prior to affor estation and while the trees are small. Peak runoff for a sample of Plynlimon floods, however, shows an average reduction of peak flows by the mature forest of the Severn (to 66% of those of the Wye). Times-to-peak analyzed for the Flood Study average 2.3 h r in the Severn and 2 hr in the Wye, although there was a faster response by the Severn in the case of a sub-sale restricted to identical rainstorm inputs. The Plynlimon experiment has made the following conclusions concerning upland hydrometric practice over the last 10 years: (1) There is no complete answer to the problems of measuring mountain precipitation. The ground-level raingage is essential for rainfall measurements in exposed sites, but it has disadvantages during snow, as does the canopy-level raingage. (2) Streamflow measuring devices need very careful maintenance; field calibration is often essential. (3) Measurements of storage and potential evapotranspiration are the least problematic in operational terms at Plynlimon. (4) All instrument systems in a difficult environment require a period of field trial, accompanied by observers and maintenance staff on the spot. (5) Studies of process, nested within a catchment experiment, require intensive staffing but can often make use of very simple techniques over short periods. They are essential to add the understanding necessary to confirm and extrapolate water balance findings. The Plynlimon study clearly has a number of continuing roles: (1) To examine every aspect of the results gathered so far on water yields, with a view to extrapolating them to other catchments and to complement them with a detailed study of the flood hydrograph under grassland and forestry. (2) To maintain the investment at Plynlimon itself in good quality upland hydrometric data, and to make further progress in instrumentation until the next important change in cropping--the felling of Hafren forest. (3) To match the increasing interest in water quality in hitherto unpolluted upland

sources by further studies of land erosion and nutrient runoff. (Humphreys-ISWS)
W80-01290

A SYSTEM FOR REGIONAL ANALYSIS OF WATER AVAILABILITY,
Oak Ridge National Lab., TN.
J. S. Jalbert, and A. D. Shepherd.
Available from the National Technical Information Service, ORNL-NOREG-TM 82, Price codes: A08 in paper copy, A01 in microfiche. Report No ORNL/NUREG/TM-82, July 1977. 165 p, 1 Fig, 8 Ref, 3 Append. W-7405-eng-26.

Descriptors: *Available water, *Regional analysis, *Powerplants, *United States, *Maryland, Analysis, Stream gages, Model studies, Computers, Data storage and retrieval, Reservoirs, Flow, Streamflow, Low flow, Data processing, Computer programs, Water resources development, Evaporation, Regional analysis systems, Powerplant siting.

The Water Analysis System (WAS) has been developed in response to the high priority given water availability analysis in power plant siting. WAS is a composition of main programs and subroutines that process streamflow information from the U.S. Geological Survey DAILY-VALUE water tapes, which contain data for all stream gaging stations in the United States. The WAS programs enable the user (1) to delimit any region of the United States by state, county, size of drainage area, or latitude-longitude frame; (2) to recall daily flow values from the USGS water tapes for all gaging stations within the study region; (3) to compute low flow recurrence frequencies and apply theoretical probability distributions; and (4) to predict the reservoir drawdown capacity necessary to maintain any given rate of streamflow at any specified rate of consumption. The WAS procedure provides a valuable tool for energy facility siting in particular and is directly applicable to many water resource questions. (Froehlich-ISWS).
W80-01295

WATER RESOURCES OF SHALLOW AQUIFERS IN THE UPPER POPLAR RIVER BASIN, NORTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
R. D. Feltis.
Geological Survey Water-Resources Investigations 79-51 (open-file report), June 1979. 23 p, 3 Fig, 2 Plates, 5 Tab, 6 Ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Hydrogeology, *Water quality, *Surface-groundwater relationships, Water wells, Groundwater movement, Groundwater recharge, Streamflow, Water analysis, Chemical analysis, Water types, Hydrologic data, Montana, *Upper Polar River basin(MT), Glacial geology.

The aquifer system studied in the upper Popular River basin in Montana ranges in age from Late Cretaceous to Holocene. Most wells obtain water from the Paleocene Fort Union Formation or younger rocks. The potentiometric surface of the Fort Union and overlying rocks indicates movement of water from the high interstream areas toward principal stream valleys. Recharge is principally through sand and gravel deposits of the Flaxville Formation, which occur as large terrace remnants, and the Wiota Gravel. Water in these formations locally recharges the underlying Fort Union Formation. Water in the gravel also emerges around the edge of the terraces as seeps and springs. Water samples from wells tapping the aquifers are of the sodium bicarbonate, magnesium bicarbonate, or calcium bicarbonate type. The range in dissolved-solids concentration for the various aquifers is: Fox Hills-Hell Creek aquifer, 940 to 1,300 mg/L; Fort Union Formation, 520 to 1,470 mg/L; glacial outwash deposits, 570 to 770 mg/L, and alluvium, 880 to 1,490 mg/L. The dissolved-solids concentration of one water sample from the Flaxville Formation was 400 mg/L. Seepage measurements of the Poplar River and East Fork Poplar River from the international boundary to the south edge of the study area in October 1977 showed a net gain of 2.84 cubic feet per second from a total flow of 11.7 cubic feet per second. This gain is discharge of water from the alluvium to the rivers. (Woodard-USGS)
W80-01422

WATER RESOURCES DATA OF THE SEWARD AREA, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 6D.
W80-01427

PROGRESS REPORT ON WATER RESOURCES OF THE TULALIP INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
B. W. Drost.
Geological Survey Water-Resources Investigations 78-31 (open-file report), 1979. 39 p, 14 Fig, 1 Plate, 8 Tab, 8 Ref.

Descriptors: *Water resources, *Evaluation, *Indian reservations, *Water quality, Streamflow, Flow rates, Lakes, Water levels, Aquifer characteristics, Water wells, Water yield, Hydrogeology, Groundwater recharge, Water level fluctuations, Tidal effects, Chemical analysis, Nutrients, Washington, *Tulalip Indian Reservation(WA).

Updated information on the Tulalip Indian Reservation's resources indicates that the newly developed tribal well field yielded about 100 million gallons of water during August 1975-October 1976. At 16 or 17 streamflow sites, mean annual discharges during the 1976 water year exceeded those of the 1975 water year by a median value of 25 percent. The levels of John Sam, Ross, and Wealup Lakes rose from 0.6 to 1.0 feet during the period October 1974-October 1976; the increase in volume stored in the three lakes was about 14.5 million gallons. The quality of surface water sampled was generally good. Nitrite and total-nitrogen concentrations tended to be greater during periods of high streamflow than during periods of low flow, whereas total-phosphorus concentrations tended to show the opposite relationship. (Woodard-USGS)
W80-01435

MOVING BOUNDARY NUMERICAL SURGE MODEL,
Oak Ridge National Lab. TN.
For primary bibliographic entry see Field 2L.
W80-01456

2B. Precipitation

A STATISTICAL TECHNIQUE FOR DETERMINING RAINFALL OVER LAND EMPLOYING NIMBUS 6 ESMR MEASUREMENTS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
For primary bibliographic entry see Field 7B.
W80-01262

CHLORINE, BROMINE AND IODINE IN MONSOON RAINS IN INDIA,
Bhabha Atomic Research Centre, Bombay (India). Air Monitoring Section.
For primary bibliographic entry see Field 2K.
W80-01291

A CLIMATOLOGY OF MOUNTAIN FOG ON MAUNA LOA, HAWAII ISLAND,
Univ. Hawaii Honolulu, Water Resources Research Center.
J. O. Juvik, and P. C. Ekern.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-118805. Price Codes: A04 in paper copy, A01 in microfiche. Technical Report No. 118, June 1978. 70 p, 28 Fig, 10 Tab, 3 Plates, 27 Ref. OWRT A-041-HT(2), 14-34-0001-5011.

Descriptors: *Clouds, *Fog, *Water balance, *Mountains, *Climatology, Effects, Ecosystems, Hawaii, *Fog regime, *Fog rainfall equivalent, Louvered fog gage, Fog gage network, Mauna Loa(Hawaii).

This study of the mountain cloud and fog regimes on the windward and leeward slopes of Mauna Loa, Hawaii Island (1) develops a standardized louvered-screen, fog catchment gage: (2) develops and indirect approximation method for estimating average droplet sizes during precipitation episodes and for separating the rainfall and fog components; (3) establishes an extensive fog sampling network on the windward and leeward slopes of Mauna Loa; and (4) develops an original computer program for detailed temporal and spatial analyses of rainfall, fog, and wind parameters. An analysis of data for the 1974 to 1976 period yielded the following conclusions: (1) a well-defined fog belt exists on windward Mauna Loa in the altitudinal zone between 1 500 to 2 500 m with fog-catchment amounts as great as one-half the rainfall, or about 750 mm; (2) mountain fog on leeward Mauna Loa increases with elevation up to a least 2 000 m, with fog amounts equivalent to one-fourth the rainfall, or about 250 mm; (3) seasonal and altitudinal patterns in fog frequence and catchment amounts are related to the dynamic interaction of the tradewind field (particularly the tradewind inversion) and the local land/sea breeze regime; (4) mountain fog appears to be a significant factor in the water balance of mountain ecosystems on Mauna Loa; and (5) the potential for large-scale mechanical recovery of fog water may exist for selected locations on Mauna Loa.
W80-01375

THE REMOVAL OF ORGANIC SURFACE FILMS BY RAIN,
Wisconsin Univ. Madison. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2H.
W80-01543

2C. Snow, Ice, and Frost

MICROCLIMATE IN FISHPOND LITTORAL ECOSYSTEMS,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2H.
W80-01218

ANISOTROPIC PROPERTIES OF SEA ICE IN THE 50- TO 150-MHZ RANGE,
Army Terrestrial Sciences Center, Hanover, NH.
A. Kovacs, and R. M. Morey.
Journal of Geophysical Research, Vol 84, No C9, p 5749-5759, September 20, 1979. 14 Fig, 3 Tab, 4 Ref.

Descriptors: *Sea ice, *Anisotropy, *Radar, Onsite investigations, Ice, Physical properties, Electromagnetic waves, Currents(Water), Equipment, Measurement, Data processing, Cold regions, Brines, Ice-brine systems, C-axis.

Results of impulse radar studies of sea ice near Prudhoe Bay, Alaska, showed that where there is a preferred current direction under the ice cover, the crystal structure of the ice becomes highly ordered. This includes a crystal structure with a preferred horizontal c axis that is oriented parallel with the local current. The radar studies showed that this structure behaves as an anisotropic dielectric. The result was that when electromagnetic energy is radiated from a dipole antenna in which the E field is oriented perpendicular with the c axis azimuth, no bottom reflection is detected. It was also found that the frequency dispersion of anisotropic sea ice varies in the horizontal plane. This was demonstrated by the center frequency of the reflected signal spectrum, which is maximum in the preferred c axis direction and minimum perpendicular to it. In addition, it was found that the frequency dispersion is related to the average bulk brine volume of the ice, but that the bulk dielectric constant of the ice, as determined from impulse travel time, shows little correlation with the coefficient of anisotropy. (Sims-ISWS)

W80-01278

GROUND FREEZING,
Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, April 1979. 558 p, H. S. Jessberger, Editor. Published by Elsevier Scientific Publishing Company, Amsterdam (The Netherlands).

Descriptors: *Frozen ground, *Porous media, *Frost, *Conferences, *Soil dynamics, Freezing, Laboratory tests, Theoretical analysis, Analytical techniques, Heat transfer, Mass transfer, Model studies, Physical properties, Mathematical studies, Thawing, Seepage, Frost action, Shear, Permeability, On-site investigations, Instrumentation, Equipment, Refrigeration, Frost heaving, Excavation, Tunneling, Thermophysical properties.

This symposium was arranged to provide an exchange of information of a scientific and technical nature about engineering with frozen soils as well as on related frost research problems. The Symposium was divided into three sessions: (1) Phase transformation of water, thermodynamic aspects, heat and mass transfer, mathematical models, and laboratory and theoretical studies of thermophysical properties. (2) Strength and creep characteristics, material behavior under sustained load, rheological and mathematical studies, properties of freezing and thawing ground as dynamic properties, thaw consolidation, shear resistance, and permeabilities at the thawing interfaces, cyclic freezing. (3) Design and calculation of frozen soil-structures, case histories: tunnelling, excavations, shafts, seepage cutoffs, frost heave aspects, calculation and dimensioning of refrigeration plants, freezing pipes, means of monitoring frost penetration, methods and instrumentation for determining the locations of boundaries of frozen soils. (See W80-01499 thru W80-01537). (Humphreys-ISWS)
W80-01498

EFFECTS OF TEMPERATURE AND PRESSURE ON FROST HEAVING,
National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
E. Penner, and T. Walton.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 29-39, April 1979. 7 Fig, 1 Tab, 3 Ref.

Descriptors: *Frost heaving, *Saturated soils, *Frost, *Laboratory tests, Freezing, Ice, Soils, Temperature, Analysis, Frost action, Overburden, Pressure, Methodology, Ice accumulation.

Concerning the influence of overburden pressure on the relation between rate of heave and cold-side temperature, studies show that the heave rate for various overburden pressures tends to converge as the cold-side temperature is lowered, and the maximum rates of ice accumulation at low pressures occur at temperatures closer to O C than do those at high pressures. Evidence was also presented that a heaving zone is involved in frost action rather than a freezing plane. This zone extends over an increasingly greater temperature range and distance as the overburden pressure is increased. Using the concept of a heaving zone leads to a method for calculating the heave-decrease curve. The period of heave decrease is marked by a rapidly increasing ice segregation ratio and a reduced frost-penetration rate. The two soils used in these experiments were a Mackenzie Valley soil (MVS 4) with a clay size content of 23%, 72% silt size, and 5% sand, and Leda clay consisting of 80% clay size particles, and the remainder in the silt size. (See also W80-01498) (Humphreys-ISWS)
W80-01499

EFFECTS OF INITIAL SOIL-WATER CONDITIONS ON FROST HEAVING CHARACTERISTICS,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
S. Kinosita.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 41-52, April 1979. 6 Fig, 2 Tab, 5 Ref.

Descriptors: *Frost heaving, *On-site tests, *Soil water, *Soils, Temperature, Frost action, Melting, Freezing, Soil water movement, Foreign research, Moisture content, Water table, Cores, Analysis, On-site investigations, *Japan, Frost penetration.

Frost heavings have been observed on the soils in waterproof basins (four basins denoted by A,B,C, and D) at the Tomakomai field site, Hokkaido, Japan. Basins A, B, and C were filled with the same silty soil, and Basin D was filled with four layers, namely, pebbles (0-5 cm below the surface), a mixture of pebbles and silty soil (5-20 cm) silty soil (20-60 cm), and sand (60-160 cm). In the winter of 1976-77, water levels in the basins were set at the levels of the ground surface in A, 40 cm below the surface in B, the bottom in C, and 30 cm below the surface in D. Basin C had no free groundwater. The highest surface heave was 32 cm in A, 26 cm in B, 19 cm in C, and 14 cm in D. A water supply from the free groundwater toward the freezing front extended over 220 cm through the silty soil, but was limited to 63 cm through the sand. The migration speeds of the soil water supplied from the unfrozen part were calculated for A, B, and C from the measurements of their volumetric water-content profiles. The migration speed of soil water from the unfrozen layer was larger in the early part of the winter; it corresponded to the existence of dense ice lenses in the upper part of the frozen layer. (See also W80-01498) (Humphreys-ISWS)
W80-01500

FROST HEAVE OF UNSATURATED LOAMY SOIL UNDER FIELD CONDITIONS,
Leningrad Inst. of Constructional Engineers (USSR).
V. D. Karlov.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 53-62, April 1979. 6 Fig, 5 Tab, 3 Ref.

Descriptors: *Frost heaving, *Soils, *On-site investigations, *Glacial soils, Loam, Freezing, Thawing, Movement, Soil physical properties, On-site tests, Soil mechanics, Frost action, Deformation, Heaving, Foreign research, Moisture content, *USSR.

A study on the heaving properties of morainal loamy soil was carried out under field conditions on two grounds. The loamy soils with broken structures were situated in the form of embankments of different density on the first ground. On the second ground, the heave of the morainal loamy soil with unbroken structure was investigated. On this ground, concrete foundations were laid 1 X 1 m in size and with pressures at the foot of 0.005 MPa, 0.025 MPa, 0.05 MPa, and 0.1 MPa. Besides, some foundations were placed on the surface, and the foot of the others was 0.5 m below the surface of the ground. The intensity of the heave of the morainal loamy soils was determined by the value of volumetrical moisture. Migration of moisture took place from thawed layers situated below to the boundary of freezing during the whole period of freezing. The increase of the external pressure upon the foundation (up to 0.1 MPa) did not result in a decrease of displacements of the most loaded foundations. The deformations of the foundation during its freezing and thawing in the limits of the foot of one foundation were relatively nonuniform. The relative deformation foundation value at maximal freezing ranged from 0.0014 to 0.014. During the thawing of the freezing loamy soil, the relative deformation of the foot of experimental foundations ranged from 0.002 to 0.048. During the thawing, the largest nonuniformity of the sediment corresponded to the most loaded foundations. The distribution of the loamy soil heave value in the limits of the experimental ground may be considered subjected to the normal law of distribution. (See also W80-01498) (Humphreys-ISWS)
W80-01501

EFFECT OF THE RATE OF HEAT REMOVAL ON THE RATE OF FROST HEAVING,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
K. Horiguchi.
In: Ground Freezing: Proceedings of the First International Sympsoium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 63-71, April 1979. 7 Fig, 11 Ref.

Descriptors: *Frost heaving, *Freezing, *Porous media, *Heat flow, Laboratory tests, Testing procedures, Heat balance, Rates, Soil physical properties, Analysis, Heaving, Zeolites, Measurement, Carborundum, Instrumentation, Cation exchange, Frost heaving rates, Alpha-alumina.

Relations between the rate of frost heaving and the rate of heat removal from the freezing front were examined under the following conditions. While the temperature of the unfrozen part of a sample saturated with water was kept at nearly 0 C throughout an experiment, the temperature of a coolant was reduced automatically at the rate of 4.5C/h. In order to lessen the experimental error in the measurement of the quantity of heat, a heat flux at the surface of the sample was taken greater than that in the field. The rate of heat removal was measured by a heat-flow meter. Powder materials used were alpha-alumina, carborundum, Linde zeolites A and X, whose exchangeable cations were exchanged by other cations. The following results were obtained: (1) As the rate of heat removal from the freezing front increased, the rate of frost heaving increased, reached the maximum, and then decreased. (2) This maximum rate increased as the particles were reduced in size, while in the cases of Linde zeolites A and X, having the same particle size, this maximum rate depended on the kinds of exchangeable cations. (See also W80-01498) (Humphreys-ISWS)
W80-01502

EFFECT OF FREEZING AND THAWING ON THE PERMEABILITY AND STRUCTURE OF SOILS,
Army Terrestrial Sciences Center, Hanover, NH.
E. J. Chamberlain, and A. J. Gow.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 73-92, April 1979. 20 Fig, 1 Tab, 11 Ref.

Descriptors: *Soil structure, *Permeability, *Freezing, *Thawing, Laboratory tests, Soils, Soil types, Laboratory equipment, Frost action, Frost, Frozen soils, Fracture permeability, Soil science, Freezing effects.

The permeability and structure of 4 fine-grained soils were observed to be changed by freezing and thawing. In all cases, freezing and thawing caused a reduction in void ratio and an increase in vertical permeability. The increase in permeability was attributed to the formation of polygonal shrinkage cracks and/or to the reduction of the volume of fines in the pores of the coarse fraction, the mechanism controlling the process depending on material type. No definite relationships were established; however, it appears that the largest increase in permeability occurs for the soil of highest plasticity. (See also W80-01498) (Sims-ISWS)
W80-01503

SEGREGATION FREEZING AS THE CAUSE OF SUCTION FORCE FOR ICE LENS FORMATION,
Army Terrestrial Sciences Center, Hanover, NH.
S. Takagi.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 93-100, April 1979. 3 Fig, 20 Ref.

Descriptors: *Freezing, *Soils, *Frozen soils, *Ice, Pore water, Soil moisture, Model studies, Mathematical models, Numerical analysis, Analytical techniques, Soil science, Suction forces, Ice lenses.

A new freezing mechanism, called segregation freezing, was proposed to explain the generation of the suction force that draws pore water up to the freezing surface of a growing ice lens. The segregation freezing temperature was derived by applying thermo-dynamics to a soil mechanics concept that distinguishes the mechanically effective pressure from the mechanically neutral pressure. The frost-heaving pressure was formulated as part of the solution of the differential equations of the simultaneous flow of heat and water, of which the segregation freezing temperature was one of the boundary conditions. (See also W80-01498) (Sims-ISWS)
W80-01504

EQUATIONS OF FROST PROPAGATION IN UNSATURATED POROUS MEDIA,
Laboratoire Central des Ponts et Chaussees, Paris (France).
J. M. Menot.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 101-109, April 1979. 3 Fig, 3 Ref.

Descriptors: *Frost, *Frozen soils, *Frozen ground, *Porous media, *Model studies, Mathematical models, Equations, Energy, Soil moisture, Temperature, Capillary action, Darcys law, Mathematics, Freezing, Frost propagation.

The equations of soil freezing were established where the soil is partially water saturated, i.e., when it contains air. A macroscopic viewpoint was chosen using leveled parameters (averages on a 'small' volume surrounding the considered point). It was assumed that water can exist at a temperature below 0 C. Mechanical energy (kinetic energy and power of inner forces) was neglected with respect to thermal energy; radiation was also neglected. The establishment of the equations was based upon the expression (1) of the mass and energy conservation laws; and (2) of constitutive laws such as Fourier's law, Darcy's law, the curve of capillary pressure in terms of the saturation degree, etc. A system of nonlinear partial differential equations was obtained with a free surface; the unknowns were the temperature, the saturation degree, and the water pressure at each point and at each time; these unknowns were coupled in the differential equations. (See also W80-01498) (Sims-ISWS)
W80-01505

THE EFFECT OF ITERATION FREQUENCY ON A NUMERICAL MODEL OF NEAR-SURFACE ICE SEGREGATION,
Michigan Univ., Ann Arbor. Dept. of Geography.
S. I. Outcalt.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4 p 111-124, April 1979. 6 Fig, 3 Tab, 10 Ref.

Descriptors: *Ice, *Frozen soils, *Frozen ground, *Model studies, Mathematical models, Numerical analysis, Equations, Soil water, Soil moisture, Freezing, Temperature, Water vapor, Frost, Analytical techniques.

It is possible to construct numerical models of the ice segregation process. Reported herein was a model which was a discrete approximation of a nonlinear continuous process and thus was subject to somewhat more pronounced effects of node geometry and calculation frequency than linear models. The model more closely simulated natural frozen soil structure when vapor phase transport was included in the model structure. An iteration frequency of 10 s appeared sufficient to yield realistic results with the exponentially spaced node geometry employed in these tests. (See also W80-01498) (Sims-ISWS)
W80-01506

CRYOGENIC TEXTURE AND STRENGTH ASPECTS OF ARTIFICALLY FROZEN SOILS,
Rutgers-The State Univ., New Brunswick, NJ. Dept. of Civil and Environmental Engineering.
A. R. Jumikis.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 125-135, April 1979. 5 Fig, 22 Ref.

Descriptors: *Freezing, *Frozen soils, *Cofferdams, Soil texture, Soil strength, Soil treatment, Frozen ground, Construction, Structures, Civil engineering, Cryogenics, Soil properties, Soil water, Groundwater, Ice, Crystals, *Artificial soil freezing.

This paper elucidated some factors affecting the formation of soil cryogenic textures upon artificial active and passive soil freezing to form a soil-ice wall cofferdam. Depending upon the soil type, the thermal regimen of the stages of active and passive freezing of the soil-ice wall brings about various kinds of cryogenic textures. The cryogenic textures, in their turn, affect the strength of the artificially frozen soil-ice wall. It was shown that upon loading, the variously oriented hexagonally crystallized ice crystals, upon application of externally applied loads may become subjected to compression or bending or shear stresses, and/or to a combination of such stresses. Also, sustained loads on a frozen soil may bring about time-dependent, long-term deformation of the ice, viz., frozen soil, known as the rheological phenomenon creep. It was postulated that the strength and performance of the composite frozen soil--the ice wall--is a function of its components, such as the soil cryogenic texture, its thermal regimen, and the strength of the ice. It was also pointed out that the performance of the ice wall should be evaluated in terms of its strength and strains. (See also W80-01498) (Sims-ISWS)
W80-01507

PREDICTION OF SALT INFLUENCE ON UNFROZEN WATER CONTENT IN FROZEN SOILS,
McGill Univ., Montreal (Quebec). Geotechnical Research Centre.
R. N. Yong, C. H. Cheung, and D. E. Sheeran.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 137-155, April 1979. 11 Fig, 2 Tab, 9 Ref.

Descriptors: *Frozen soils, *Salts, *Pore water, *Model studies, Mathematical models, Theoretical analysis, On-site investigations, Data processing, Soils, Soil water, Soil moisture, Soil types, Montomorillonite, Kaolinite, Solutes, Saline soils, Temperature, Frozen ground, Ice, Grundite.

The influence of salts in the pore water in freezing soils was examined from the experimental viewpoint, using the differential scanning calorimetry technique for generation of multiple endotherms of the frozen test samples. The experimental values obtained for montmorillonite, kaolinite, and grundite were evaluated in terms of unfrozen water contents for the respective soils at various subfreezing temperatures for various concentrations of NaCl. Comparison of experimental values with theoretical predictions using a combined salt exclusion and diffuse double-layer model showed excellent quantitative agreement for the montmorillonite soil samples, but only qualitative agreement appeared for the kaolinite and grundite soil. The reasons for this lie in the theoretical model requirement for interlamellar migration of water in soil freezing for suitable application of the diffuse double-layer part of the model. (See also W80-01498) (Sims-ISWS)
W80-01508

UNFROZEN WATER AS A FUNCTION OF CLAY MICROSTRUCTURE,
Lulea Univ. (Sweden). Div. of Soil Mechanics.
R. Pusch.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 157-162, April 1979. 6 Fig, 4 Ref.

Descriptors: *Frozen soils, *Soil water, *Freezing, Laboratory tests, Soils, Soil types, Clays, Aggregates, Frozen ground, Analytical techniques, Soil science.

A previous study of microstructural changes in freezing clay suggested that a 'dispersed' freshwater clay should have a higher percentage of unfrozen water than a (leached) marine clay with similar mineralogical and granulometrical compositions. This report described an investigation where two such clays were actually compared concerning their contents of unfrozen water. The results confirmed the hypothesis. Thus, the influence of clay microstructure on the amount of unfrozen water was clearly shown. The degree of particle aggregation and the density of the particle aggregates are the main microstructural parameters. (See also W80-01498) (Sims-ISWS)
W80-01509

INTERRELATIONSHIP OF THE PRINCIPAL PHYSIOCOMECHANICAL AND THERMO-PHYSICAL PROPERTIES OF COARSE-GRAINED FROZEN SOILS,
Kuybyshevskii Inzhenero-Stroitelnyi Inst. (USSR). Frozen Soil Science and Power Plant Construction Branch Research Lab.
N. A. Tsytovich, and Ya. A. Kronik.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 163-167, April 1979. 9 Ref.

Descriptors: *Frozen soils, *Soil properties, *Soil types, *Construction, Cryogenics, Freezing, Frozen ground, Physical properties, Mechanical properties, Thermal properties, Aggregates. Particle size, Soils, Soil science.

The results of physical, mechanical, and thermomechanical investigations of frozen coarse-grained soils with sandy clay aggregate were discussed. A general classification of coarse-grained soils with fine aggregate, subdividing into skeleton and nonskeleton soils, and new methods for determination of their physicomechanical and thermal characteristics were proposed. Special methods and formulas were given that allow calculation of the main physiocomechanical and thermal characteristics of coarse-grained soils in the same way as those of coarse particles and fine aggregates. In common complex stability and deformation problems and in research on frozen, freezing, and thawing soils, taking into account cryogenic and thermo mass transfer processes, it was proposed to investigate these soils on the basis of thermoelasticity and thermomechanics (rational thermodynamics). (See also W80-01498) (Sims-ISWS)
W80-01510

ICE LENS STRUCTURES, COMPRESSION STRENGTHS AND CREEP BEHAVIOR OF SOME SYNTHETIC FROZEN SILTY SOILS,
Continental Oil Co., Ponca City, OK.
F. J. Radd, and L. H. Wolfe.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 169-183, April 1979. 8 Fig, 5 Tab, 3 Ref.

Descriptors: *Ice, *Frozen soils, *Frozen ground, Laboratory tests, Soil strength, Compressive strength, Soil properties, Creep, Mechanical properties, Construction, Structures, Soils, Soil types, Freezing, Sampling, Cryogenics, Soil science, Ice lenses.

This research paper concerned the frozen state properties of several silty soils encountered in the construction of a large LNG storage cavern near Carlstadt, New Jersey. The creep and compression strengths were correlated with both field and laboratory measured mechanical properties. These cryogenic mechanical properties were related to ice lens structures, sizes, and occurrences, and to

heat flow and geological structure effects. Three distinct and separate types of ice lenses were identified. These cryogenic ground data pertain to the prediction of the engineering properties of frozen earth for large structures. Sample size effect problems were investigated, this in relationship to the number and size and orientations of the ice lenses present. (See also W80-01498) (Sims-ISWS)
W80-01511

CREEP BEHAVIOUR OF FROZEN SOILS IN UNIAXIAL COMPRESSION TESTS,
Karlsruhe Univ. (Germany, F.R.). Inst. of Soil Mechanics and Rock Mechanics.
For primary bibliographic entry see Field 8D.
W80-01512

CREEP CHARACTERISTICS OF FROZEN SOILS,
Shimizu Construction Co., Ltd., Tokyo (Japan).
For primary bibliographic entry see Field 8D.
W80-01513

EFFECT OF SPECIMEN SHAPE ON CREEP RESPONSE OF A FROZEN SAND,
Ecole Polytechnique de Montreal (Quebec). Centre d'Ingenierie Nordique.
For primary bibliographic entry see Field 8D.
W80-01514

STRAIN RATE EFFECT ON THE COMPRESSIVE STRENGTH OF FROZEN SAND,
National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
For primary bibliographic entry see Field 8D.
W80-01515

CYCLIC TRIAXIAL TESTS ON FROZEN SAND,
Michigan State Univ., East Lansing.
J. C. Li, G. Y. Baladi, and O. B. Andersland.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 233-246, April 1979. 13 Fig, 11 Ref.

Descriptors: *Frozen soils, *Sands, *Laboratory tests, Youngs modulus, Silica, Strain, Measurement, Soil physical properties, Analysis, Methodology, Analytical techniques, Cycles, Frequency, Instrumentation, Loads(Forces), Temperature, *Triaxial tests, Ottawa sand, Confining pressure, Axial strain.

Strain-controlled cyclic triaxial tests were performed on a one-size silica (Ottawa) sand artificially frozen into 71.1-mm-diameter cylindrical samples. Ice-saturated samples with three different sand contents were tested under the following conditions: axial strains ranging from 0.003 to 0.03%, confining pressures from zero to 1.378 MPa, frequencies of 0.05-5.0 cps, and temperatures from -1 to -10C. Test equipment included an MTS electrohydraulic closed-loop testing system which applies the load to the sample, a triaxial cell completely immersed in a low-temperature coolant for temperature control, a refrigeration unit for control of the coolant temperature and constant coolant circulation, and measuring devices including an LVDT and load cell, together with recording devices such as a digital multimeter, an oscilloscope, a strip-chart recorder, and a minicomputer. Test results indicated that the dynamic Young's modulus increases with increasing frequency, confining pressure and sand content, but decreases with increasing strain and temperature. The damping ratio decreases with increasing frequency, sand content and lower temperatures. The influence of confining pressures and axial strain on the damping ratio are less explicit for the ranges considered. The experimental results were compared with data from other sources. Available data cover only low (0.1-10 cps) and high (1000 to 10,000 cps) frequencies. The longitudinal wave velocity increases gradually with increasing frequency and appears to be relatively independent of soil type. The damping ratio decreases with increasing loading frequency. Damping ratios for the Ottawa sand are intermediate to the frozen silt and clay soils. (See also W80-01498) (Humphreys-ISWS)
W80-01516

EFFECT OF FREEZE-THAW CYCLES ON RESILIENT PROPERTIES OF FINE-GRAINED SOILS,
Army Terrestrial Sciences Center, Hanover, NH.
T. C. Johnson, D. M. Cole, and E. J. Chamberlain.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 247-276, April 1979. 25 Fig, 1 Tab, 20 Ref.

Descriptors: *Freeze-thaw tests, *Frozen soils, *Soils, *Soil physical properties, On-site tests, Laboratory tests, Methodology, Testing procedures, Mechanical properties, Clays, Silts, Deformation, Soil temperature, Analysis, Analytical techniques, Poisson ratio, Triaxial tests, Resilient modulus, Hanover silt, Morin clay.

Stress-deformation data for silt and clay subgrade soils were obtained from in-situ tests and laboratory tests for use in mechanistic models for design of pavements that will experience freezing and thawing. Plate-bearing tests were run on in-service, all-bituminous-concrete (ABC) pavements constructed directly on silt subgrade and on an experimental ABC pavement constructed on clay subgrade, applying repeated loads to the pavement surfaces while the subgrade was frozen, thawing, thawed, and fully recovered. The in-service pavement had experienced several seasons of natural cyclic freezing and thawing, while the experimental pavement was artificially frozen and thawed twice. Repeated-load laboratory triaxial compression tests were performed on the same soils in the frozen and thawed states. Analysis of deflection data from the in-situ tests showed resilient moduli of the subgrade soils up to more than 10 GPa when frozen, as low as 2 MPa during the thawing period, and up to more than 100 MPa when fully recovered. Analysis of the laboratory tests, which gave moduli comparable to the latter values, showed that resilient modulus and Poisson's ratio in the thawed and recovering conditions can be expressed as a function of the stress state, the moisture content, and the dry density. (See also W80-01498) (Humphreys-ISWS)
W80-01517

PRESSURE OF THAWING SOILS ON THE CONCRETE LINING OF VERTICAL MINE SHAFTS,
Research Inst. of Bases and Underground Structures, Gosstroi (USSR).
F. Ya. Novikov.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 277-286, April 1979. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Frozen soils, *Frozen ground, *Thawing, *Shafts, Mines, Mining, Structures, Model studies, Mathematical models, laboratory tests, Soil moisture, Ice, Concrete, Mining engineering, Mine shafts.

This paper presented data on the theoretical and experimental investigations for revealing characteristic features of the development of pressure of thawing clayey soils on the concrete lining of mine shafts. The concrete shaft lining and frozen soil massif were considered as rigid walls resting on a rigid base (bedrock). While the thawing soil is being consolidated due to gravity, because of friction and cohesion it transmits loads on to the walls. The report showed that the development of the loads on the mine shaft lining due to soil thawing is divided into two stages. This paper presented the technique of experiments effected on the mine shaft models. It was noted that, owing to nonuniform thawing of soils close to the mine shaft, the soil displacement begins on the side with the greater thawing. This may cause nonuniform lateral pressure on the concrete mine shaft lining, endangering its stability. (See also W80-01498) (Sims-ISWS)
W80-01518

SOME ASPECTS OF ARTIFICIAL THAWING OF FROZEN SOILS,
Rutgers-The State Univ., New Brunswick, NJ.
A. R. Jumikis.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 287-297, April 1979. 3 Fig, 14 Ref.

Descriptors: *Frozen soils, *Frozen ground, *Permafrost, *Thawing, Model studies, Mathematical models, Heat flow, Temperature, Construction, Cold weather construction, Civil engineering, Soil defrosting, Artificial thawing.

Despite its important practical value, the problem of artificial thawing of frozen soils by the vertical, cylindrical defreezer-pipe method has been studied only comparatively recently. To facilitate excavation and/or foundation work in frozen soil in seasonally freezing and/or permafrost regions, the frozen soil can be loosened up, among other methods, by artificial thawing. For this purpose, it is necessary to evaluate the amount of thermal energy needed to bring about the desired thawing. Such an evaluation involves consideration of the relationships between the frozen and thawed soil properties; temperature of the defrosting agent; the size and spacing of the defreezer pipes; and the time required to thaw a certain amount of frozen soil. Although in practice several methods are used for artificial thawing, in this paper discussion on and calculations for defrosting of frozen soil were presented relative only to thawing by means of vertically installed defreezer pipes. (See also W80-01498) (Sims-ISWS)
W80-01519

ICE BEAHAVIOUR UNDER LOAD,
All-Union Designing, Surveying and Scientific Research Inst. Hydroproject, Moscow (USSR).
Yu. K. Zaretsky, B. D. Chumichev, and V. I. Solomatin.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 299-309, April 1979. 7 Fig, 10 Ref.

Descriptors: *Ice, *Loads(Forces), *Compressive strength, *Frozen ground, Frozen soils, Strain, Stress, Creep, Failure(Mechanics), Rheology, Laboratory tests, Model studies, Mathematical models, Mechanical properties, Deformation, Elastic deformation, Temperature.

Ice is a component of frozen grounds that determines their rheological properties. Deformation and failure of ice under load were regarded by the authors as a single process due to the kinetics of defect development in the crystalline structure of ice. Results of experimental investigations into the regularities of ice strain and failure under the conditions of short-time creep were given in this paper. The experiments were to test ice for creep under a uniaxial compressive stress, using the emission-acoustic method of recording the microcrack formation. It was shown experimentally that the ultimate strength of ice signifying a maximum stress after which ice deforms plastically, without passing into the stage of accelerated flow, is consistent with the stress under which the process of microcrack formation begins. It was found that this limit is independent of temperature. As a result of the study, an analytical relationship was determined between defect number, stress, and time, and an equation of ice strain was deduced on the basis of statistical methods. This equation estimates temporal creep strain development, depending on stress, structural characteristics of ice, and its temperature. (See also W80-01498) (Sims-ISWS)
W80-01520

THERMAL AND RHEOLOGICAL COMPUTATIONS FOR ARTIFICALLY FROZEN GROUND CONSTRUCTION,
Army Terrestrial Sciences Center, Hanover, NH.

F. J. Sanger, and F. H. Sayles.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 311-337, April 1979. 16 Fig, 1 Tab, 32 Ref.

Descriptors: *Frozen ground, *Construction, *Freezing, *Model studies, Mathematical models, Frozen soils, Cofferdams, Retaining walls, Hydraulic structures, Ice, Creep, Strength, Soil strength, Rheology, Civil engineering, Artifical freezing, Frozen ground construction.

Design consideration for frozen retaining structures were summarized and included geology and groundwater conditions; ground deformations due to freezing; the strength and deformation of the frozen earth retaining structures; the thermal assumption and methods of computation; and the refrigeration system. Brief case histories of typical construction projects that illustrate the use of mechanical refrigeration and liquid nitrogen for freezing were presented. Emphasis was placed on the constitutive equation for creep deformation of frozen earth structures and the thermal calculations for predicting times to freeze a structure as well as estimating the energy and power required for different stages of freezing. (See also W80-01498) (Sims-ISWS)
W80-01521

STABILITY OF MINE WORKINGS IN FROZEN SOILS,
Research Inst. of Bases and Underground Structures, Gosstroi (USSR).
S. S. Vyalov, Yu. K. Zaretsky, and S. E. Gorodetsky.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 339-351, April 1979. 6 Fig, 1 Tab, 3 Ref.

Descriptors: *Frozen soils, *Frozen ground, *Mining, *Freezing, Model studies, Mathematical models, Construction, Retaining walls, Ice, Strength, Creep, Stability, Equations, Mining engineering, Artificial freezing.

The laws of rheological processes (creep and long-term strength) occurring in frozen soils were considered, and initial equations were formulated. Methods for determining the strength and deformability characteristics were described; the values of these characteristics were given. Methods were considered for calculating the optimum thickness of the walls of ice-soil retaining structures built by means of artificial freezing as well as methods of design for creep and long-term strength of the frozen soil surrounding various mine workings. The corresponding calculation equations were given; graphs were attached to facilitate the use of these equations. The calculation techniques were illustrated with examples. (See also W80-01498) (Sims-ISWS)
W80-01522

CREEP STRESS ANALYSIS OF FROZEN SOILS UNDER MULTIAXIAL STATES OF STRESS,
Bochum Univ. (Germany, F.R.). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8D.
W80-01523

DESIGN OF TUNNEL SUPPORT SYSTEMS USING GROUND FREEZING,
Law Engineering Testing Co., McLean, VA.
For primary bibliographic entry see Field 2G.
W80-01525

GROUND FREEZING MONITORING TECHNIQUES,
International Versuchsanstalt for fuer Fels G.m.b.H., Bentheim (Germany, F.R.). Interfels.
For primary bibliographic entry see Field 2G.
W80-01530

GROUND CONSOLIDATION WITH LIQUID NITROGEN (LN2),
Linde A.G., Hollriegelskreuth (Germany, F.R.). Technical Gases Div.
G. Veranneman, and D. Rebhan.
In: Ground Feeezing: Proceedings of the First International Sympsoium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 473-484, April 1979. 6 Fig.

Descriptors: *Frozen ground, *Frozen soils, *Freezing, *Consolidation, Equipment, Methodology, Nitrogen, Cooling, Temperature, Construction, Model studies, Laboratory tests, On-site investigations, Civil engineering, Liquid nitrogen, Artificial freezing.

A brief introduction to the method was given, and the technical details of practical interest, such as the nitrogen supply system, materials, equipment, and safety precautions, were discussed. Laboratory tests were carried out to ascertain basic data. The test setup, test procedure, and results were set forth. Information essential to the planning of nitrogen freeze operations was obtained. The practical application of the method was illustrated by reference to several examples. Nitrogen freezing is gaining steadily in importance, thanks to a series of technical benefits allied to the need for cleaner and safer building methods. The specific nitrogen consumption was indicated, and the question of efficiency was discussed. (See also W80-01498) (Sims-ISWS)
W80-01531

USES AND LIMITATIONS OF GROUND FREEZING WITH LIQUID NITROGEN,
Deilmann-Haniel G.m.b.H., Dortmund (Germany, F.R.).
K. Stoss, and J. Valk.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 485-494, April 1979. 4 Fig, 2 Tab.

Descriptors: *Frozen ground, *Frozen soils, *Freezing, *Consolidation, Nitrogen, Cooling, Temperature, Construction, Retaining walls, Tunnels, Costs, Cost comparison, Methodology, Civil engineering, Liquid nitrogen, Artificial freezing.

The question whether ground freezing by direct gasification of liquid nitrogen (LN2) is an alternative to conventional freezing by circulation of liquid coolants was discussed. Also discussed were: the technical characteristics of and basic differences between the two methods; the specific advantages and disadvantages of ground freezing with LN2; the relevant cost factors and their influence on the overall cost of a freezing project; and the criteria for the technical and economic feasibility of LN2 freezing in construction work. A description was given of four typical applications: for temporary foundations; sealing of a defective diaphram wall; final sealing of a designed gap in a bored pile retaining wall; and driving of a water tunnel under a railway embankment. (See also W80-01498)(Sims-ISWS)
W80-01532

NATURAL FROST IN IMPROVEMENT OF CONSTRUCTION PROPERTIES OF GROUND IN HYDROENGINEERING AND INDUSTRIAL AND CIVILIAN CONSTRUCTION,
Akademiya Nauk SSSR, Yakutsk. Inst. Merzuotovedeniya.
P. I. Mel'nikov, V. I. Makarov, G. F. Biyanov, and L. I. Kudoyarov.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (German), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 495-503, April 1979. 5 Fig.

Descriptors: *Frozen ground, *Permafrost, *Cold regions, *Construction, Freezing, Heat transfer, Cooling, Cold weather construction, Frozen soils, Strength, Foundations, Structures, Civil engineering, Artificial freezing, Artificial ground freezing, Thermosiphons.

Artificial freezing of ground by refrigerating machines requires considerable power and expense, so it is comparatively seldom applied and almost always for a short period. In the regions of severe climate, seasonal freezing and long-term preservation of low temperatures in a mass of frozen ground can compete in effectiveness and economy with the traditional methods of loose ground stabilization, quicksand and boggy-clayey deposits, in particular. In practice, different methods and systems are applied for freezing the ground using the cold atmosphere air as a heat-adsorbing medium. Systems with forced pumping of the intermediate heat carrier or of the air itself are more economical than machine freezing, but they are unreliable and maintenance is very expensive. Freezing devices using natural circulation of a single-phase and double-phase heat carrier in hermetically sealed cavities or thermosiphons permit effective temperature variation of the ground and atmosphere air with the minimum operating expense. The paper considered the operational features of freezing systems and different devices, and gave examples of the utilization of artificially frozen ground in hydraulic structures and in foundations of industrial buildings and dwelling houses. The possiblity of creating artificially frozen masses used as foundations of the structures built in severe climatic regions was considered, and examples of the existing buildings constructed on the artificial lenses of frozen ground were given. (See also W80-01498) (Sims-ISWS)
W80-01533

FROST PROTECTION OF RAILWAY LINES,
Norwegian State Railways, Oslo (Norway).
H. Hartmark.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 505-517, April 1979. 10 Fig, 3 Tab, 26 Ref.

Descriptors: *Frost protection, *Railroads, *Frost, Frozen ground, Drainage, Frost heaving, Insulation, Peat, Bark, Methodology, Plastics, Foreign countries, *Norway, *Sweden, *Finland, Foam plastic.

The modern operation of railways with speeds of more than 100 km/h with all-welded rails and concrete sleepers demands a railway line completely free of frost heave. On railway lines in service (in operation), protection against frost is achieved by materials demanding only a minimum insulation depth, i.e., peat, bark, discarded sleepers, or foam plastic. The combination of foam plastic with a gravel layer beneath is the most sidely used method today (1978). Since 1945, the Norwegian State Railways have carried out frost protection works. In Sweden and Finalnd, systematic frost protection work has been carried out, mainly on the same principles as in Norway. This paper described the methods being used in railway construction with dimensional diagrams for frost insulation. (See also W80-01498) (Humphreys-ISWS).
W80-01534

APPLICATION OF THE GROUND-FREEZING METHOD TO PENETRATE A SEQUENCE OF WATER-BEARING AND DRY FORMATIONS--THREE CONSTRUCTION CASES,
Thyssen Schachtbau G.m.b.H., Mulheim an der Ruhr (Germany, F.R.).
For primary bibliographic entry see Field 2G.
W80-01537

2E. Streamflow and Runoff

EFFECTS OF SUBURBAN CONSTRUCTION ON RUNOFF CONTRIBUTING ZONES IN A SMALL SOUTHERN ONTARIO DRAINAGE BASIN,
Trent Univ., Peterborough (Ontario). Dept. of Geography.
C. H. Taylor, and D. M. Roth.
Hydrological Sciences Bulletin, Vol 24, No 3, p 289-301, September 1979. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Runoff, *Construction, *Urbanization, *Effects, *Canada, Rainfall, Snowmelt, Seasonal, Precipitation(Atmospheric), Storm runoff, Peak discharge, Urban runoff, Hydrographs, Land use, Soil moisture, Infiltration, Hydrology, Suburban construction effects.

The runoff response of a small drainage basin in southern Ontario has been monitored over a 5 year period, during which 25% of its surface has been modified by suburban construction activity. Direct runoff response to summer and autumn rainstorms has not been noticeably affected by the development, but response to spring snowmelt has increased by three to four times. Summer and autumn storm runoff still appears to be generated mainly by direct precipitation on a natural, saturated, contributing zone alongside the channel which has been little affected by the construction activity. The construction surfaces have had their infiltration capacities greatly reduced by devegetation and compaction, but runoff from them does not contribute to the storm hydrograph unless ephemeral channels and swales which link them to the main stream are saturated and capable of conducting flow. This happens rarely during rainstorms, but consistently during snowmelt, when ground conditions are extremely wet. The seasonal contrasts in the effect of partial suburban development on direct runoff response are caused, therefore, by seasonal variations in the extent to which the construction surfaces are integrated into the active runoff contributing zone of the drainage basin. (Sims-ISWS).
W80-01272

FLOW AND FLOW ROUTING IN UPLAND CHANNEL NETWORKS,
Institute of Hydrology, Wallingford (England).
K. Beven, K. Gilman, and M. Newson.
Hydrological Sciences Bulletin, Vol 24, No 3, p 303-325, September 1979. 15 Fig, 4 Tab, 42 Ref.

Descriptors: *Flow, *Channel flow, *Streamflow , Channels, Networks, Open channel flow, Routing, On-site investigations, Watersheds(Basins), Discharge(Water), Velocity, Tracers, Measurement, Model studies, Mathematical models, Hydrographs, Hydrology, Channel networks, Flow routing.

This paper was based on the premise that the distribution of discharge source areas in relation to the channel network may have a significant effect on the form of the basin hydrograph, and that, in consequence, it is of value to investigate routing models for application to the channel networks of upland catchments. The channels of such networks are generally small, steep, and rough, with complex flow through a sequence of pools and riffles or rapids. The gulp dilution gauging method provided a useful technique for investigating the bulk properties of flow over complete channel reaches. At least for low to medium flows, it was shown that average flow velocities increase nonlinearly both downstream and with increasing discharge in a manner that is not compatible with traditional analysis in terms of uniform flow equations. The dilution gauging measurements may be used to provide parameters for a nonlinear kinematic routing model. The model was applied to channel networks of two small British basins (about 8 sq km), and the response to different hydrograph magnitudes was explored. The model provided a suitable compromise between the requirements of simplicity and the inclusion of the nonlinearity in channel response, but, at the scale of application, the model parameter values derived from the field measurements may overestimate velocities at high discharges. (Sim-ISWS)
W80-01273

RESUME OF RESEARCH INTO RIVER CHANNEL CHANGES CONDUCTED IN THE USSR,
Gosudarstvennyi Gidrologicheskii Inst., Leningrad (USSR).
For primary bibliographic entry see Field 2J.
W80-01274

FLOOD SIMULATION MODEL,
Public Works Research Inst., Tsukuba (Japan).
A. Tsuchiya, K. Ishizaki, and K. Sasaki.
Hydrological Sciences Bulletin, Vol 24, No 3, p 361-373, September 1979. 11 Fig, 1 Tab, 2 Ref.

Descriptors: *Floods, *Simulation analysis, *Model studies, Mathematical models, Flood forecasting, Flood recurrence interval, Flood plains, Rivers, Unsteady flow, Streamflow, Rainfall, Precipitation(Atmospheric), Hydrographs, Drainage, Watersheds(Basins), Hydrology, *Japan, *Tomoe River(Japan).

In Japan, low flat flood-prone areas are increasingly being developed. This paper described a flood simulation model based on unsteady flow for calculating floods in such regions. The model was applied to the Tomoe River basin. (Sims-ISWS)
W80-01275

PROBABILITY ANALYSIS OF HISTORICAL FLOOD DATA,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
R. Gerard, and E. W. Karpuk.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14834, p 1153-1165, September 1979. 6 Fig, 1 Tab, 5 Ref.

Descriptors: *Flood frequency, *History, *Flood data, Backwater, Bridges, Flood control, Ice jams, Probability, Rivers, Frequency analysis, Hydrology, *Flood historical data, Ice breakup.

In addition to routinely collected hydrometric data, information on past river water levels at a site can often be gathered from various other sources such as residents and archives. However, these sources generally have varying reliability, overlapping and broken periods of record, and no well-defined reference levels--features that have made the probability analysis of this data difficult. The paper described a simple method of incorporating such data into probability analyses and illustrated it by application to the probability analysis of ice breakup stages on the Peace River at Fort Vermilion, Alberta, Canada. There is generally little standard hydrometric information on such water levels, and yet they are often a very significant component of the annual maximum water levels in cold regions. In such situations, the analysis of historical data is particularly important. (Lee-ISWS)
W80-01279

OPEN CHANNEL FLOW WITH VARYING BED ROUGHNESS,
Birmingham Univ. (England).
D. W. Knight, and J. A. Macdonald.
Journal of the Hydraulics Division,American Society of Civil Engineers, Vol 105, No HY9, Proceedings Paper 14839, p 1167-1183, September 1979. 11 Fig, 1 Tab, 24 Ref, 2 Append.

Descriptors: *Boundary layers, *Flumes, *Open channel flow, Roughness coefficient, Roughness (Hydraulic), Flow, Equations, Velocity, Turbulence, Walls, *Boundary shear, Velocity distribution, Bed roughness, Open channel hydraulics.

The distribution of velocity and boundary shear stress in a rectangular flume has been examined experimentally, and the influence of varying the bed roughness and aspect ratio was assessed. The resistance of the channel bed was varied by means of artificial strip roughness elements, and measurements were made of the wall and bed shear stresses. Dimensionless plots of both shear stress and shear force parameters were presented for different bed roughnesses and aspect ratios, and these serve to illustrate the complex way in which such parameters vary. The definition of a 'wide' channel was also examined, and a graph giving the limiting aspect ratio for different roughness conditions was presented. The boundary shear stress distributions and isovel patterns were used to examine one of the standard side-wall correction procedures. One of the basic assumptions underlying the procedure was found to be untenable due to the cross channel transfer of linear momentum. (Lee-ISWS)
W80-01280

FLOOD PLAIN INFORMATION: CUCHARAS RIVER AND TRIBUTARIES, LA VETA, COLORADO,
Army Engineer District, Albuquerque, NM.
Prepared for the Huerfano County Board of County Commissioners, NM, May 1977. 26 p 5 Fig, 22 Plates, 5 Tab.

Descriptors: *Colorado, *Flood data, *Flood frequency, *Peak discharge, *La Veta(CO), *Cucharas River(CO), *Floods, Indirect flood measurement, Flood profiles, Historic floods, Flood frequency interval, Flood stages, Flood peak, Flow duration, Flow charactristics, Stage-discharge relations, Flood protection, Warning systems, Huerfano County(CO), Boyd Ranch(CO), Middle Creek(CO), 100-year flood, 500-year flood.

The study area encompasses the flood plain of the Cucharas River near the community of La Veta and vicinity. The flood plain contains agricultural developments, cattle raising, some mining and a small amount of residential development. Flood data were collected from a stream gaging station near Boyd Ranch, NM, field surveys, and interviews with local citizens. There are no flood control structures on the stream that would affect flooding in La Veta and vicinity. The greatest precipitation in the study area mormally occurs in the late spring and summer months. Storms characteristic of the area are usually of the thunderstorm or cloudburst type. Definitive data on velocities, magnitude, and duration of past floods in La Veta are not available. Interviews with local citizens disclosed that flooding did occur in 1923 and 1946. The 100-year flood occurring about the mouth of Middle Creek is predicted to have a discharge of 6,100 cubic feet per second (cfs) and reach a height of 3.3 feet above bankfull stage. The 500-year flood is predictd to have a peak discharge of 11,600 cfs and reach a height of 4.2 feet above bankfull stage. This report provides a suitable basis for land use planning to guide flood plain development and prevent future losses. (Coan-NC)
W80-01400

FLOOD PLAIN INFORMATION: CUCHARAS RIVER AND TRIBUTARIES, WALSENBURG, COLORADO,
Army Engineer District, Albuquerque, NM.
Prepared for the Huerfano County Board of County Commissioners, CO, July 1977. 24 p 3 Fig, 18 Plates, 5 Tab.

Descriptors: *Colorado, *Flood data, *Peak discharge, *Walsenburg(CO), *Cucharas River(CO), *Floods, Indirect flood measurement, Flood profiles, Historic floods, Flood frequency, Flood stages, Flood peak, Flow duration, Flow characteristics, Flood protection, Non-structural alternatives, Flood plain insurance, Warning systems, Control structures, Dams, Huerfano County(CO), 100-year flood, 500-year flood.

The study area covers the flood plains of Cucharas River, Bear Creek, and the North Walsenburg Ditch near Walsenburg, Colordo and vicinity. Existing developments on the flood plains in the study area are primarily residential but include commercial and industrial developments. Large amounts of the flood plains are rural land. Flood data were obtained from topographic maps, field visits, and intensive interviews with local citizens. The North Walsenburg Flood Control Project provides flood control to North Walsenburg and flood plain management standards have been adopted. Storms characteristic of the watershed are usually of the thunderstorm of cloudburst type occurring in the early spring. No data presentd concerning historical floods although interviews with local citizens report that flooding did occur on August 6, 1936. On the Cucharas River at station 0+00 the 100-year flood would discharge 23,700 cubic feet per second (cfs) and the 500-year flood would discharge 48,200 cfs with a rise of 7 and 9 feet, respectiely, above bankfull stage. On Bear Creek at station 24+10, the 100-year flood would discharge 11,300 cfs and the 500-year flood, 23, 100 cfs. This report will aid in the development

of flood damage reduction methods and provide a suitable basis for land use planning. (Coan-NC)
W80-01401

FLOOD PLAIN INFORMATION: GILMORE CREEK, BURNS VALLEY CREEK, PLEASANT VALLEY CREEK, VICINITY OF WINONA, MINNESOTA,
Army Engineer District, St. Paul, MN.
Prepared for the City of Winona, MN, May 1975. 36 p, 14 Fig, 19 Plates, 5 Tab.

Descriptors: *Minnesota, *Flood profiles, *Flood data, *Peak discharge, *Flood plains, *Gilmore Creek(MN), *Burns Valley Creek(MN), *Winona(MN), *Pleasant Valley Creek(MN), Floods, Indirect flood measurement, Historic floods, Flood recurrence interval, Flood stages, Flood peak, Flow duration, Flow characteristics, Rivers, Flood protection, Flood plain zoning, Control structures, Flow control, Levee, Reservoirs, Standarad Project Flood, Control structures, Flow control, Levee, Reservoirs, Standard Project Flood, Intermediate Regional Flood.

The study area includes the flood plains of Gilmore, Burns Valley, and Pleasant Valley Creeks in the vicinity of Winona, Minnesota. Development in the flood plains are primarily agricultural but scattered residential developments exist along the entire lengths of the valleys. Flood data were gathered from U.S. Geological Survey stream gages, historical documents, and topographic maps. Flood control structures in the area consist of reservoirs, levees, and sediment settling basins; there is some flood plain zoning. The largest floods in the area are usually caused by intense rainfall of short duration which occur during spring and summer. The worst recorded flood in the area occurred on July 21, 1951, on Gilmore Creek, with a peak discharge of 5,360 cubic feet per second (cfs) and reaching an elevation of 681.9 feet mean sea level (msl). The Intermediate Regional Flood peak discharges for Gilmore, Burns Valley, and Pleasant Valley Creeks would be 7,140 cfs, 9,200 cfs, and 9,050, respectively. For the Standard Project Flood, the peak discharge for Gilmore Creek would be 12,900 cfs, for Burns Valley Creek, 18,500 cfs, and for Pleasant Valley Creek, 17,800 cfs. This report provides a suitable basis for the adoption of land use control to guide flood plain development and for adopting other flood damage reduction techniques. (Coan-NC)
W80-01403

FLOOD HAZARD INFORMATION: ANIMAS RIVER AND HERMOSA CREEK, HERMOSA, COLORADO,
Army Engineer District, Sacramento, CA.
Prepared for La Plata County and the Animas Regional Planning Commission, CO, October 1977. 14 p, 5 Fig, 32 Plates, 5 Tab.

Descriptors: *Colorado, *Floods, *Flood profiles, *Storms, *Cloudbursts, *Flood peak, *Flow characteristics, *Flood plain insurance, *Hermosa Creek(CO), *Animas River(CO), *Hermosa(CO), *La Plata County(CO), Flood flow, Indirect flood measurement, Flood forecasting, Historic floods, Flood data, Flood stages, Flood damage, Erosion, Rivers, Floodways, Flood plains, Flood protection, Non-structural alternatives, 100-year flood, 500-year flood.

The study area covers the Animas River and Hermosa Creek in the vicinity of Hermosa, La Plata County, CO. A 13.6 mile stretch of the Animas River and 2.8 mile reach of the Hermosa Creek were investigated. The Animas River is a tributary of the Colorado River and combined with Hermosa Creek drains an area of 1,374 square miles. Development in the floodplain is mainly agricultural, with some rural residences and limited commercial development. Flooding is caused by large rainstorms, rapidly melting snow and localized cloudburst storms; the flood season is from mid-June-December. Obstructions to flood waters consist mainly of natural vegetation plus a few bridges. Recent floods have occurred in 1949, 1952, 1957, 1970 and 1973. The greatest flood on the Animas River occurred in 1911 with a peak flow of 25,000 cubic feet per second (cfs), while the greatest flood on Hermosa Creek was in 1941 with a peak flow of 2,980 cfs. For the 100-year flood the peak flow for the Animas River and Hermosa Creek would be 25,000 cfs and 4,400 cfs, respectively; for the 500-year flood the peak flow would be 42,000 cfs and 6,300 cfs, respectively. There are no existing or authorized flood control reservoirs in the study area. La Plata County is eligible for federal flood insurance. This report will aid in planning the best use of lands subject to flooding from the 100- and 500-year floods. (Iervolino-NC)
W80-01412

FLOOD HAZARD INFORMATION: COLORADO RIVER AND TRIBUTARIES: FRUITA, CO,
Army Engineer District, Sacramento, CA.
Prepared for the Town of Fruita and Mesa County, CO, November 1976. 9 p, 55 Plates, 5 Tab.

Descriptors: *Colorado, *Floods, *Flood profiles, *Peak discharge, *Floodways, *Colorado River(CO), *Fruita(CO), *Mesa County(CO), Indirect flood measurement, Flood damage, Erosion, Rivers, Flood protection, Non-structural alternatives, Flood plain zoning, Land use, Zoning, Reed Wash(CO), Big Salt Wash(CO), Little Salt Wash(CO), 100-year flood, 500-year flood.

The study area includes the Colorado River in Colorado and three of its direct tributaries: Reed, Big Salt and Little Salt Washes, all in the vicinity of Fruita, CO. The drainage area totals 17,100 square miles for the Colorado River and 177 square miles for the three tributaries combined. Data were collected for 12 miles along the Colorado River from 22 Road downstream to about 13 Road and for a total of 5.7 miles for all three Washes. Development in the flood plain is mainly agricultural. The cause of flooding is snowmelt in the spring and it is most severe when augmented by rain. Obstructions to floodflow are mainly natural materials such as trees, brush and other vegetation. The earliest and most severe flood occurred during June-July 1884. Other floods occurred in 1917, 1920, 1921, 1935, 1952, and 1957. For the 100-year flood the peak flow was 82,000 cubic feet per second (cfs), 3,500 cfs, 7,900 cfs, and 4,300 cfs for the Colorado River, Reed Wash, Big Salt Wash and Little Salt Wash, respectively. The peak flow for the 500-year flood would be 107,000 cfs, 7,600 cfs, 16,700 cfs, 8,100 cfs, respectively, for the same streams. Average velocities for the 100-year flood would be 7-9 feet per second (fps) for the main channel of the Colorado River, 8-10 fps for the Reed Wash channel, 6-8 fps for the Big Salt Wash channel and 8-12 fps for the Little Salt Wash channel. Formal operating regulations for flood control have not been prepared for the study area. Flood plain regulations have been adopted by Mesa County. (Iervolino-NC)
W80-01413

FLOOD HAZARD INFORMATION: YAMPA RIVER AND TRIBUTARIES, CRAIG, COLORADO,
Army Engineer District, Sacramento, CA.
Prepared for the City of Craig and Moffat County, CO, November 1977. 25 p, 11 Fig, 44 Plates, 5 Tab.

Descriptors: *Colorado, *Floods, *Flood flow, *Indirect flood measurement, *Flood forecasting, *Flood profiles, *Historic floods, *Flood data, *Flood stages, *Peak discharge, *Flood peak, *Flood protection, *Non-structural alternatives, *Flood plain insurance, *Yampa River(CO), *Craig(CO), River flow, Flood damage, Rivers, Floodways, Flood plains, Channels, Ice jams, Control structures, Levee, Channel improvement, 100-year flood, 500-year flood, Fortification Creek(CO), Brotherton Gulch(CO), Cedar Mt. Gulch(CO), Pine Ridge Gulch(CO), Moffat County(CO).

The study area covered by this report includes 7 miles of the Yampa River and the lower reaches of its tributaries--Fortification Creek, and Brotherton, Cedar Mt. and Pine Ridge Gulches--in and around Craig, CO. The drainage area for the Yampa River is 2130 square miles and for the tributaries a combined area of 272 square miles. Development in the flood plain is mainly agricultural and grazeland. New development consists of construction related to energy production. Flooding is caused by rapidly melting snow augmented by general rain from March to June and caused by ice jams in late Winter and early Spring. Obstructions to floodflow consist of natural vegetation and bridges and culverts. Major floods have occurred a number of times, most recently in 1947 and 1974. The largest floodflow was recorded during the 1947 flood and was 841 cubic feet per second (cfs). For the 100-year flood and 500 year flood, peak flow for the Yampa River would be 18,300 and 29,000 cfs, respectively. On fortification Creek, peak flows would be 3,600 and 12,400 cfs, respectively. Average velocities for the 100-year flood would be 5 feet per second for the Yampa River and 6 feet per second for Fortification Creek in their main channels. Following the 1947 flood emergency flood control work consisted of channel improvement and the construction of low, soil-type levees. No formalized flood control projects are in effect. Both the City of Craing and Mofffat County are eligible for Flood insurance under the emergency phase of the National Flood Insurance Program and both jurisdictions have adopted resolutions assuring implementation of a suitable flood plain management program. (Iervolino-NC)
W80-01414

FLOOD HAZARD INFORMATION: COLORADO RIVER AND TRIBUTARIES, GRAND JUNCTION, COLORADO,
Army Engineer District, Sacramento, CA.
Prepared for City of Grand Junction and Mesa County, CO, November 1976. 11 p, 74 Plates, 5 Tab.

Descriptors: *Colorado, *Floods, *Flash flood, *Indirect flood measurement, *Flood stages, *Peak discharge, *Flood peak, *Non-structural alternatives, *Flood plain zoning, *Colorado River(CO), *Grand junction(CO), *Mesa County(CO), Flood flow, River flow, Flood forecasting, Storms, Cloudbursts, Historic floods, Flood data, Flood damage, Erosion, Rivers, Floodways, Flood plains, Flood protection, Land use, Zoning, Control structures, Levee, Dikes, 100-year flood, 500-year flood.

This report covers 12 miles of the Colorado River and a combined 12 miles of the Gunnison River, Leach Creek, Lewis Wash and Horizon Drive Channel, all tributaries of the Colorado River in the vicinity of Grand Junction, Mesa County, CO. The drainage area of the study length of the Colorado River is 17,100 square miles and for the tributaries is a combined 7,962 square miles. The area is extensively irrigated with much of the rural land in agricultural development. Floods in the area are caused by rapidly melting snow in spring and early summer and from intense rainfall from cloudburst storms. Obstructions to floodflow are natural vegetation and bridges and culverts. The most severe flood in Grand Junction occurred in 1884; the largest recorded flow on the Gunnison River was in May 1920. Recent floods were recorded in 1935, 1952, and 1957. For the 100-year flood the peak flow of the Colorado River below the mouth of the Gunnison River would be 82,000 cubic feet per second (cfs) and on the Gunnison River at Grand Junction the peak flow would be 20,000 cfs. At the same locations the 500-year flood peak flow for the Colorado River would be 107,000 cfs, and for the Gunnison River, 25,000 cfs. Emergency flood damage protection is provided by levees and low dikes. Reservoirs in the area are mainly for water conservation and provide only incidental flood protection. Mesa County adopted flood plain regulations and has incorporated designated flood plans into county zoning maps, including low hazard and floodway zones. (Iervolino-NC)
W80-01415

COASTAL FLOOD OF FEBRUARY 7, 1978, IN MAINE, MASSACHUSETTS, AND NEW HAMPSHIRE,
Geological Survey, Boston, MA. Water Resources Div.

R. A. Gadoury.
Geological Survey Water-Resources Investigations 79-61 (open-file report), 1979. 57 p, 8 Fig, 2 Plates, 2 Tab, 9 Ref.

Descriptors: *Floods, *Flood damage, *Maine, *Massachusetts, *New Hampshire, Coasts, Storms, Tides, Winds, Ocean waves, High water mark, Seashores, Historic floods, Flood data, *Coastal floods.

On February 6-8, 1978, New England was battered by one of the most severe winter storms of record. The storm produced record snowfall in many areas of Rhode Island and Massachusetts. Spring high tides (sun and moon in such alinement as to cause the highest tides of the month), a stationary storm center, and hurricane force winds combined to produce record high flood levels along much of the Massachusetts to Maine coastline on February 7. Tidal gages recorded new highs of 10.4 feet in Boston, Massachusetts, and 9.6 feet in Portland, Maine. Fifty-four lives were lost because of the storm. Property damage was greatest along the Massachusetts coastline north of Cape Cod. The total cost of the storm--principally property damage, snow removal, and economic losses--approached $1 billion. This report contains data which document the flooding along parts of the New England coast. Elevations of 203 floodmarks in Massachusetts, 104 in Maine, and 46 in New Hampshire are given. Also included are some historical coastal flood data and a list of other storm-related studies. (Woodard-USGS)
W80-01420

SMALL-STREAM FLOOD INVESTIGATIONS IN MINNESOTA, OCTOBER 1958 TO SEPTEMBER 1977, WITH FLOODS FROM SELECTED LARGER DRAINAGE AREAS,
Geological Survey, St. Paul, MN. Water Resources Div. .
G. H. Carlson, and K. T. Gunard.
Geological Survey open-file report 79-1061, 1979. 194 p, 9 Fig, 1 Tab, 7 Ref.

Descriptors: *Floods, *Streamflow, *Small watersheds, *Minnesota, *Peak discharge, Flow characteristics, Drainage area, Topography, Vegetation, Flood frequency, Gaging stations, Stage-discharge relations, *Basin characteristics.

An investigation of flood flows from small drainage basins in Minnesota is being made to aid in the design of bridges, culverts and other highway drainage structures. Results of the investigation provide peak-flow data on streams generally with drainage areas less than 50 square miles, placing particular emphasis on those with drainage areas less than 10 square miles. Basin parameters being investigated for their effect on floods are drainage area, length of main stream, slope of main channel, basin altitude, forest cover, and storage area. All the 163 gaging stations included in the report are equipped with crest-stage gages, and 10 stations are equipped to record stage and precipitation continuously. The relative magnitude of flood flows for different hydrologic regions is shown in graphs that relate maximum discharge to drainage area. Station records contain location, drainage area, records available, type of gage, on-site structure elevations, bankfull stage, and annual maximum stage and discharge data. The data form the basis for statewide flood-frequency studies. (Woodard-USGS)
W80-01432

FLOODS IN CENTRAL TEXAS, AUGUST 1978,
Geological Survey, Austin, TX. Water Resources Div.
E. E. Schroeder, B. C. Massey, and K. M. Waddell.
Geological Survey open-file report 79-682, April 1979. 121 p, 18 Fig, 6 Tab, 6 Ref.

Descriptors: *Floods, *Flood discharge, *Storms, *Peak discharge, *Flood damage, Rainfall-runoff relationships, Flood data, Streamflow, Flow rates, Gaging stations, Flood frequency, Historic floods, Water quality, Texas, *Tropical storm Amelia(1978).

Catastrophic floods, which resulted in millions of dollars in property damages and the loss of 33 lives, occurred in Central Texas during August 1-4, 1978, as a result of intense rainfall produced by tropical storm Amelia. Rainfall in excess of 30 inches was unofficially reported at several locations, while the highest 24-hour amount recorded by the National Weather Service was 29.05 inches at Albany in Shackelford County. Major flooding occurred on the Media River and tributaries above Medina Lake and on the Guadalupe River and tributaries above Canyon Lake. Minor to severe flooding occurred on the tributaries of the Nueces River, on the Clear Fork Brazos River and tributaries, and on the Llano and Pedernales Rivers, which are tributaries of the Colorado River. Peak discharges at several streamflow stations exceeded the historic peaks, and the flood magnitude and frequency data for the Guadalupe River above Canyon Lake, the Medina River near Pipe Creek, and Clear Fork Brazos River indicate that the August 1978 flood had a recurrence interval in excess of 100 years. The highest unit discharge observed during this flood was 3,010 cubic feet per second from a 14.1-square-mile drainage area of Spring Creek, which is tributary to the Pedernales River. (Woodard-USGS)
W80-01440

THE EFFECT OF MAINTENANCE ON STORM WATER DETENTION BASIN EFFICIENCY,
Maryland Univ., College Park. Dept. of Civil Engineering.
G. E. Kamedulski, and R. H. McCuen.
Water Resources Bulletin, Vol. 15, No. 4, p 1146-1152, August 1979. 3 Tab, 8 Ref. OWRT A-047-MD (2), 14-34-0001-8022.

Descriptors: *Storm water, *Urban runoff, *Basins, Floods, Flood control, Sediments, Sediment control, Maintenance, Effects, Sedimentation, Vegetation, Vegetation effects, Runoff, Storm runoff, Hydrology, Urbsan hydrology, *Detention basins, Detention.

Storm water detention is an effective and popular method for controlling the effects of increased urbanization and development. Detention basins are used to control both increases in flow rates and sedimentation. While numerous storm water management policies have been proposed, they most often fail to give adequate consideration to maintenance of the basin. Sediment accumulation with time and the growth of grass and weeds in the emergency spillway are two maintenance problems. A model that was calibrated with data from a storm water detention basin in Montgomery County, Maryland, was used to evaluate the effect of maintenance on the efficiency of the detention basin. Sediment accumulation in the basin caused the peak reduction factor to decrease, while accumulation increased as vegetation growth in the emergency spillway increased. Thus, the detention basin will not function as intended in the design when the basin is not properly maintained. Thus, maintenance of detention basins should be one component of a comprehensive storm water management policy. (Sims-ISWS)
W80-01582

FLOOD HYDROLOGY OF BUTTE BASIN, 1973-77 WATER YEARS, SACRAMENTO VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. G. Simpson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 454. Price Codes: A09 in paper copy, A01 in microfiche. Geological survey Water-Resources Investigations 78-86, October 1978. 70 p, 24 Fig, 8 Tab, 11 Ref.

Descriptors: *Floods, *California, *Streamflow, *Flood profiles, *Flood stages, Data collections, Gaging stations, Peak discharge, Flow rates, Flow characteristics, Water levels, Streams, *Butte Basin(CA), *Sacramento Valley(CA), *Sacramento River(CA).

Flooding in Butte Basin, CA., is caused primarily by overflow from the Sacramento River on the western boundary. Stage and discharge data were collected during 1973-77 at 6 recording and 45 crest-stage gages within the basin and combined with discharge records on the main channel of the Sacramento River to determine total flow and flow distribution at the latitudes of Ord Ferry, Butte City, and Gridley Road. Water-surface profiles throughout the basin, inflow/change-in-storage/outflow relations of the Butte Sink, and channel changes of the Sacramento River are shown. During 1973-77, total peak flows decreased an average of 7 percent between the latitudes of Ord Ferry and Butte City, with measured peaks from 100,000 to 200,000 cfs (cubic feet per second). The largest floodflow measured was 195,000 cfs on January 17, 1974, at the latitude of Ord Ferry. For a given flood, overland flow did not change significantly in peak magnitude between Afton Boulevard, Butte City, and Gridley road. Overland flows of about 45,000 and about 24,000 cfs were measured on January 18 and April 1, 1974, respectively. (Woodard-USGS)
W80-01589

2F. Groundwater

OUTCROP STUDY OF A COMPLEX SAND AQUIFER TO AID IN THE INTERPRETATION OF SUBSURFACE DATA,
Mississippi State Univ., Mississippi State.
D. M. Keady, and T. W. Lins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-112725, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University, Report, October 1979. 20 p, 10 Fig. OWRT-A-119-MISS (1), 14-34-0001-9026.

Descriptors: *Sand aquifers, *Sedimentary structures, *Facies(Sedimentary), Beds(Stratigraphic), Mississippi, *Meridian-upper Wilcox aquifer system, Meridian Sand, Hatchetigbee Formation, Outcrop study.

Outcrop study of sedimentary sequences in central and eastern Mississippi equivalent to the down-dip Meridian-upper Wilcox aquifer system demonstrates that the sands were deposited in different depositional settings. The true Meridian sand was deposited as shoals in a sand-deficient environment during slow transgression of a sea. The time-equivalent Hatchetigbee sands northwest of the Meridian area also consist of shoal sands, but were deposited in a series of step ups during a more rapid transgression in an area receiving more sand from a different source. Both sands are characterized by similar sedimentary structures--large amplitude, tabular crossbeds succeeded vertically by small amplitude, tabular cross beds. The Meridian sands contain glauconite, marine burrows, and quartzite granules, which are not present in the Hatchetigbee sands. Northwest of the area of Hatchetigbee step up the stratigraphic interval studied becomes dominated by sands of fluvial origin. Regionally, in the subsurface, the Meridian sands were deposited over delta-margin facies, whereas the sands of the Hatchetigbee step up were deposited over deltaic facies. An understanding of the depositional setting and depositional environments of the aquifer system can be of considerable value to those involved in the exploration of ground water.
W80-01260

AN APPLICATION OF A METHOD FOR COMPARING ONE-DIMENSIONAL AND TWO-DIMENSIONAL MODELS OF A GROUNDWATER FLOW SYSTEM,
California Univ., Livermore, Lawrence Livermore Lab.
T. G. Naymik.
Available from the National Technical Information Service, UCRL-52541, Price codes: A03 in paper copy, A01 in microfiche. Report UCRL-52541, 1978. 28 p, 19 Fig, 4 Tab, 3 Ref, 1 Append.

Descriptors: *Hydraulic gradient, *Model studies, *Groundwater movement, Mathematical studies, Geohydrologic units, Nuclear wastes, Waste disposal, Aquifers, Flow, Porosity, Hydraulic con-

ductivity, Travel time, One-dimensional models, Two-dimensional models.

To evaluate the inability of a one-dimensional groundwater model to interact continuously with surrounding hydraulic head gradients, simulations using one-dimensional and two-dimensional groundwater flow models were compared. This approach used two types of models: flow-conserving one-and-two dimensional models, and one-dimensional and two-dimensional models designed to yield two-dimensional solutions. The hydraulic conductivities of controlling features were varied, and model comparison was based on the travel times of marker particles. The solutions within each of the two model types compared reasonably well, but a three-dimensional solution was required to quantify the comparison. (Visocky-ISWS)
W80-01296

GROUND-WATER AVAILABILITY IN TEXAS, ESTIMATES AND PROJECTIONS THROUGH 2030,
Texas Dept. of Water Resources, Austin.
D. A. Muller, and R. D. Price.
Report 238, September 1979. 84 p, 12 Fig, 7 Tab, 104 Ref, 2 Append.

Descriptors: *Groundwater availability, *Texas, *Aquifers, *Projections, *Groundwater, Estimating, Hydrologic cycle, Hydrogeology, Data collections, Groundwater resources, Aquifer characteristics, Model studies, Water quality, Water supply, Groundwater recharge, River basins, Annual, Alluvial aquifers, Analysis, Analytical techniques.

The purpose of this report was to present information on the quantity of groundwater available in the State of Texas on an average annual basis through the year 2030. The study provided estimates of the amounts of effective recharge and the amounts of water that can be recovered from storage for selected aquifers in the State. This appraisal re-evaluated and updated the groundwater availability data of the major and minor aquifers as presented in the 1968 Texas Water Plan and considered additional aquifers where pertinent information has been obtained. The scope of the study encompassed the collection, compilation, and analysis of data relating to groundwater availability such as: determination of the regional and statewide location and extent of the major and minor aquifers; the available annual effective recharge to each aquifer; computation by best available methods of the amount of groundwater in storage that is available for development in selected aquifers; and incorporation of results from using digital mathematic computer models of the Ogallala, Carrizo-Wilcox, Edwards (Balcones Fault Zone), Hueco Bolson, and Gulf Coast aquifers. The average annual groundwater availability from the major and minor aquifers in the State of Texas ranges from approximately 10.2 million acre-feet in 1980 to 8.4 million acre-feet in the year 2030. These estimates utilize 5.1 million acre-feet as annual effective recharge, and the remainder is groundwater recoverable from storage in particular aquifers. Current appraisals indicate that approximately 397.6 million acre-feet is in total storage in these particular aquifers, of which about 327.8 million acre-feet is considered to be recoverable. (Humphreys-ISWS)
W80-01297

OCCURRENCE, AVAILABILITY, AND CHEMICAL QUALITY OF GROUND WATER IN THE EDWARDS PLATEAU REGION OF TEXAS,
Texas Dept. of Water Resources, Austin.
L. E. Walker.
Report 235, July 1979. 346 p, 21 Fig, 8 Tab, 97 Ref, 17 Maps.

Descriptors: *Texas, *Groundwater, *Water quality, *Data collections, *Aquifers, Groundwater availability, Census, Water properties, Chemical analysis, Geologic formations, Aquifer characteristics, Maps, Groundwater resources, Dissolved solids, Brines, Oil, Water wells, Well data, Geology, Water levels, Springs, Water supply, Water utilization, Water yield, Municipal water, Domestic water, Industrial water, Irrigation water, Livestock, *Edwards Plateau(TX), Chemical quality.

The scope of the study included the collection and compilation of all available data pertaining to the occurrence, availability, and chemical quality of water in the Edwards-Trinity (Plateau) aquifer and other aquifers on the Edwards Plateau. The plateau is located in southwest Texas and lies between 98 deg and 103 deg west longitude and 29 deg and 32 deg north latitude. The area composes approximately 23,000 square miles and includes all or parts of 28 counties. The region is bounded on the west by the Pecos River; on the north, northwest, and northeast by the physical limit of the Cretaceous rocks; on the east by the Llano uplift; on the south and southeast by the Balcones fault system; and on the southwest by the Rio Grande. The principal aquifers, or water-bearing units, in order of importance and development are the Edwards-Trinity (Plateau), composed of the Antlers Formation and the Edwards and associated limestones; the alluvium; the lower Cretaceous, composed of the Hosston, Sligo, Pearsall, and Glen Rose Formations; the Hickory; and the Ellenburger-San Saba. Other units that yield fresh to slightly saline water in limited areas on or near the Edwards Plateau are the Ogallala aquifer and rocks of Pennsylvania, Permian, and Triassic age. The total amount of fresh to slightly saline groundwater available from all the aquifers on the Edwards Plateau is more than 450,000 acre-feet per year. Water levels are declining in the Edwards-Trinity (Plateau) aquifer in areas of heavy pumping in Ector, Glasscock, Midland, Reagan, and Upton Counties. The water is generally very hard, but treatment methods can be used to remove calcium carbonate. Other undesirable dissolved minerals such as sulfate, chloride, and fluoride are present in varying amounts in water from the Antlers Formation; however, the water has been used for most purposes without apparent harmful results. (Humphreys-ISWS)
W80-01298

RECORDS OF WELLS, CHEMICAL ANALYSES, AND WATER LEVELS OF SELECTED EDWARDS WELLS, BEXAR COUNTY, TEXAS,
Texas Dept. of Water Resources, Austin.
G. L. Marquardt, and G. R. Elder.
Report 237, July 1979. 461 p, 2 Fig, 4 Tab, 17 Ref.

Descriptors: *Texas, *Groundwater, *Water wells, *Basic data collections, *Well data, Water properties, Dissolved solids, Hardness(Water), Salts, Chemical analysis, Water quality, Water levels, Water yields, Hydrogen ion concentration, Silica, Iron, Calcium, Magnesium, Sodium, Potassium, Carbonates, Sulfates, Chlorides, Nitrates, Boron, Fluorides, *Bexar County(TX), *Edwards Aquifer(TX), Water well locations.

This report contained basic data on selected wells in Bexar County, Texas, including well-location map, records of 694 water wells, records of water levels in 119 wells, and chemical analyses of water samples from 204 wells. All of the wells selected for this report are high-capacity wells completed in the Edwards (Balcones Fault Zone) aquifer, except for 6 wells which are lacking completion data but do have long-term records of water-level measurements. The term 'high-capacity wells' as used in this report implies wells capable of yielding in excess of 500 gallons per minute. The wells can also be categorized as active or inactive. The inactive wells are those which presently are not being used but could be placed on active status within a short time. Also included in the record of wells, because of their importance as stratigraphic control points, are plugged wells that have been logged by mechanical methods. Logs of those wells are available for reference in the files of the Texas Department of Water Resources. (Humphreys-ISWS)
W80-01299

GROUND-WATER AVAILABILITY IN PARTS OF THE CHICOPEE AND MILL RIVER BASINS, NEAR WILBRAHAM, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
D. F. Delaney.
Geological Survey Water-Resources Investigations 79-72 (open-file report), 1979. 1 Sheet, 14 Ref.

Descriptors: *Groundwater resources, *Groundwater availability, *Subsurface mapping, *Hydrogeology, *Aquifers, Bedrock, Till, Glacial drift, *Wilberham(MA), *Chicopee River Basin(MA), *Wilbraham River Basin(MA).

Ground water in the Wilbraham area occurs in glacial drift and in underlying bedrock. Stratified sand and gravel deposits form the principal unconsolidated aquifers. These aquifers are generally less than 50 feet thick in most of the study area; however, an area in north-central Wilbraham, near the Chicopee River, is underlain by stratified drift deposits more than 200 feet thick that may be capable of yielding more than 300 gal/min (gallons per minute) to individual wells. Bedrock aquifers are generally of two types: Triassic and Jurassic sedimentary rock lies west of a north-south trending fault, and Paleozoic metamorphic, and igneous rock lies east of the fault. The median yield of wells in sedimentary bedrock is 15 gal/min; yields range from 2 to 110 gal/min. The median yield of wells in crystalline rock is 5 gal/min; yields range from less than 1 to 60 gal/min. (Woodard-USGS)
W80-01424

PRELIMINARY DATA FOR MADISON LIMESTONE TEST WELL 3, NW1/4 SE1/4 SEC. 35, T. 2 N., R. 27 E., YELLOWSTONE COUNTY, MONTANA,
Geological Survey, Denver, CO. Water Resources Div.; Geological Survey, Huron, SD. Water Resources Div.; Geological Survey, Billings, MT. Water Resources Div.
R. K. Blankennagel, L. W. Howells, W. R. Miller, and C. V. Hansen.
Geological Survey open-file report 79-745, June 1979. 186 p, 7 Fig, 3 Plates, 3 Tab, 5 Ref.

Descriptors: *Groundwater resources, *Potential water supply, *Test wells, *Water quality, *Montana, Data collections, Hydrogeology, Borehole geophysics, Cores, Drillers logs, Well data, Aquifer testing, Geochemistry, Chemical analysis, Groundwater availability, Limestones, *Yellowstone County(MT), *Madison limestone, Northern Great Plains.

This report provides preliminary data for Madison Limestone test well 3 in Yellowstone County, Mont., including test-well history, geology of the test well, hydrologic testing, and geochemistry. It also discusses the preliminary results and future testing. The test well was drilled as part of the study to determine the water-resource potential of the Madison Limestone and associated rocks to meet future water needs in a 188,000-square-mile region that includes the coal-rich area of the Northern Great Plains. Drilling and testing were designed to yield a maximum of stratigraphic, structural, geophysical, and hydrologic information. (Woodard-USGS)
W80-01434

APPROXIMATE ALTITUDE OF WATER LEVELS IN WELLS IN THE CHICOT AND EVANGELINE AQUIFERS IN THE HOUSTON AREA, TEXAS, SPRING 1977 AND SPRING 1978,
Geological Survey, Houston, TX. Water Resources Div.
R. K. Gabrysch.
Geological Survey open-file report 79-334, February 1979. 4 Sheets.

Descriptors: *Groundwater, *Water wells, *Water levels, *Potentiometric level, *Maps, Contours, Aquifers, Texas, *Houston area(TX), Chicot aquifer, Evangeline aquifer.

Four maps show water levels in wells in the Houston, Texas, area in (1) the Chicot aquifer, spring 1977; (2) the Evangeline aquifer, spring 1977; (3) the Chicot aquifer, spring 1978; and (4) the Evangeline aquifer, spring 1978. Both the Chicot and Evangeline aquifers are composed of several sand layers with different potentiometric surfaces.

These maps, however, show approximations of single potentiometric surfaces that represent composite hydraulic heads. (Woodard-USGS)
W80-01437

IDENTIFICATION OF AQUIFER DISPERSIVITIES IN TWO-DIMENSIONAL TRANSIENT GROUNDWATER CONTAMINANT TRANSPORT: AN OPTIMIZATION APPROACH,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
A. Umari, R. Willis, and P. L-F. Liu.
Water Resources Research, Vol 15, No 4, p 815-831, August 1979. 3 Fig, 10 Tab, 26 Ref, 1 Append.

Descriptors: *Aquifers, *Hydraulic properties, *Unsteady flow, *Mass transfer, *Optimization, Water pollution, Wastes, Aquifer characteristics, Computer models, Porosity, Velocity, Seepage, Finite element analysis, *Dispersivity, *Inverse problem, Transport.

The problem of identifying unknown aquifer dispersivities in two-dimensional transient groundwater contaminant transport from given observations on the concentration field was addressed. This inverse problem was formulated as a general nonlinear programming problem, the purpose of which is to minimize the discrepancy between calculated and observed values of the concentration field. The method of quasilinearization was used to linearize the above problem, and the inverse algorithm becomes the solution of a sequence of linear programs that converge to the solution of the original nonlinear problem. The finite elements method in conjunction with finite differencing was used to discretize the governing differential equations which were then used as constraints for the optimization (mathematical programming) problem stated above. The effect on the inverse problem of the choice of observation points, objective function, number of finite elements, size of time step, and observation errors was studied. The proposed identification algorithm was shown to be fast, stable, and accurate. (Visocky-ISWS)
W80-01449

LONG-TERM WATER SUPPLY POTENTIAL, GREEN SWAMP AREA, FLORIDA,
Geological survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-01588

GROUND WATER IN THE VICINITY OF CAPULIN, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 6D.
W80-01592

LOW-FLOW CHARACTERISTICS OF STREAMS IN THE LAKE SUPERIOR BASIN, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
W. A. Gebert.
Geological Survey Water-Resources Investigations 79-38 (open-file report), April 1979. 74 p, 6 Fig, 3 Plates, 3 Tab, 15 Ref.

Descriptors: *Low-flow, *Streamflow, *Low-flow frequency, *Base flow, *Flow duration, Equations, Regression analysis, Analytical techniques, *Lake Superior basin(Wis).

Low-flow characteristics of streams in the Lake Superior basin include estimates of low-flow frequency and flow duration at 9 gaging stations, low-flow frequency at 16 low-flow partial-record stations and 38 miscellaneous sites; and a list of base-flow discharge measurement is available. The equations were determined from multiple-regression analyses that relate low-flow characteristics. The standard error of estimate is provided for each method of estimating the annual minimum 7-day mean flow below which the flow will fall on the average of once in 2 years and once in 10 years. Standard error provides the user with the expected degree of accuracy for each method. (Woodard-USGS)
W80-01596

HYDROGEOLOGIC DATA FOR THE EAGLE RIVER-CHUGIAK AREA, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
P. Johnson.
Geological Survey Water-Resources Investigations 79-59 (open-file report), 1979. 17 p, 2 Fig, 1 Tab, 1 Ref.

Descriptors: *Hydrology, *Groundwater resources, *Aquifer characteristics, *Water yield, Water levels, Water wells, Well data, Hydrologic data, Maps, Alaska, *Eagle-River-Chugiak area(Alaska).

Water for the Eagle River-Chugiak area, Alaska, is provided by private, subdivision and trailer court wells. Data from these wells were studied to determine aquifer materials, yield, well depth and depth to water. The aquifer material is unconsolidated glacial or alluvial gravel and sand and bedrock from the McHugh Complex, the unnamed metamorphic complex and the Kenai Formation. The median well yield for bedrock wells is 2 gallons per minute and the median well yield for wells completed in unconsolidated aquifers is 10 gallons per minute. Well depths may vary widely where wells are drilled into bedrock or glacial till but are more uniform where wells are drilled into alluvial gravels and sand. A continuous water table is not defined in the Eagle-Chugiak area. (Woodard-USGS)
W80-01597

2G. Water In Soils

STRUCTURE AND CHEMISTRY OF THE FISHPOND BOTTOM,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
D. Dykyjova, and B. Ulehlova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 141-152, 1978. 8 Fig, 4 Tab.

Descriptors: *Ponds, *Soil analysis, *Muck soils, *Soil chemistry, Wetlands, Freshwater marshes, Peat, Organic matter, Soil types, Mud.

In the Trebon basin, Czechoslovakia, unsaturated freshwater marsh soils occur on acid sand, clay, or peat and in some places on transitional types to more base-saturated subsoils. Owing to intense decomposition and mineralization of organic material, the water is nutrient-richer in the vegetated littoral than in the open pelagial. The bottom and water chemistry of the reed belt depend on the shore configuration and wave motion, so that two essentially different kinds of fishpond habitats or zones occur: the accumulation and the erosion zone. Two main types of submerged soils occur in the Opatovicky fishpond, Czechoslovakia: (1) unsaturated sandy soils of mineral origin with blue-grey impermeable clay layer in the subsoil and (2) pseudo-gleys or semigleys prevailing on clay subsoil. Typical rusty dots and veins of precipitated Fe +3 occur in the gleyic layers around the fine roots of the emergent plants. In sheltered bays, especially on the eastern shore, large amounts of organic detritus are accumulated, giving rise to deep layers of humic organic soils gradually filling the bays. (See also W80-01209) (Steiner-Mass)
W80-01221

MEASURING HYDRAULIC CONDUCTIVITY IN CLAY SOILS: METHODS, TECHNIQUES, AND ERRORS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia).
For primary bibliographic entry see Field 7B.
W80-01265

THE DIFFUSION AND NONEQUILIBRIUM THERMODYNAMIC EQUATIONS OF WATER VAPOR IN SOILS UNDER TEMPERATURE GRADIENTS,
Tokyo Univ. (Japan); and Shikoku National Agricultural Experiment Station.
M. Nakano, and T. Miyazaki.
Soil Science, Vol 128, No 3, p 184-188, September 1979. 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Diffusion, *Water vapor, *Soils, *Soil temperature, *Thermal properties, Equations, Mathematical models, Theoretical analysis, Pores, Gases, Soil water movement, Density, Moisture content. *Ficks law, Temperature gradient, Air density gradient, Transport.

Based on the observation that temperature is a function of distance, Fick's law of diffusion was extended as widely as possible to apply to the movement of water vapor in soils under temperature gradients. The general equations developed as a result were expressed using (1) water vapor pressure, (2) water vapor density, (3) the Clapeyron equation, and (4) the form of phenomenological equations in nonequilibrium thermodynamics. From comparisons with the equations derived in several previous reports, it was concluded that the earlier results may be valid only under the condition that the total water potential is larger than 0.000001 centimeters. (Visocky-ISWS)
W80-01266

EFFECT OF SURFACE ROUGHNESS ON THE MICROWAVE EMISSION FROM SOILS,
Computer Sciences Corp., Silver Spring, MD.
For primary bibliographic entry see Field 7B.
W80-01277

FLOW NET FOR UNSATURATED INFILTRATION FROM STRIP SOURCE,
Karadeniz Teknik Univ., Trabzon (Turkey). Dept. of Civil Engineering and Architecture.
V. Batu.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 105, No IR 3, Proceedings Paper No 14822, p 233-245, September 1979. 3 Fig, 30 Ref, 2 Append.

Descriptors: *Infiltration, *Potential flow, *Unsaturated flow, *Groundwater recharge, *Mathematical models, Groundwater movement, Analysis, Flow nets, Hydrodynamics, Permeability, Steady flow, Seepage, Streamlines, Stream function, Equi-potential lines.

The steady-state, unsaturated flow equation linearized by using the Kirchhoff transformation with an exponential relationship between unsaturated hydraulic conductivity and soil water pressure was solved for the two-dimensional case. A general equation in integral form was obtained for the stream function under a variable infiltration rate from a strip located on the soil surface. The total potential functions were derived using the matrix-flux potential distributions. Several graphical flow nets were presented for different soil parameters. Comparisons between the saturated and unsaturated streamlines were made, and it was concluded that the discrepancies increase with decreasing water content in the flow field. (Adams-ISWS)
W80-01281

MOBILIZATION AND ACCUMULATION OF HEAVY METALS IN FRESHWATER WETLANDS,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 5G.
W80-01379

GROUND FREEZING,
For primary bibliographic entry see Field 2C.
W80-01498

EFFECTS OF TEMPERATURE AND PRESSURE ON FROST HEAVING,
National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
For primary bibliographic entry see Field 2C.
W80-01499

EFFECTS OF INITIAL SOIL-WATER CONDITIONS ON FROST HEAVING CHARACTERISTICS,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
For primary bibliographic entry see Field 2C.
W80-01500

FROST HEAVE OF UNSATURATED LOAMY SOIL UNDER FIELD CONDITIONS,
Leningrad Inst. of Constructional Engineers (USSR).
For primary bibliographic entry see Field 2C.
W80-01501

EFFECT OF THE RATE OF HEAT REMOVAL ON THE RATE OF FROST HEAVING,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
For primary bibliographic entry see Field 2C.
W80-01502

EFFECT OF FREEZING AND THAWING ON THE PERMEABILITY AND STRUCTURE OF SOILS,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 2C.
W80-01503

SEGREGATION FREEZING AS THE CAUSE OF SUCTION FORCE FOR ICE LENS FORMATION,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 2C.
W80-01504

EQUATIONS OF FROST PROPAGATION IN UNSATURATED POROUS MEDIA,
Laboratoire Central des Ponts et Chaussees, Paris (France).
For primary bibliographic entry see Field 2C.
W80-01505

THE EFFECT OF ITERATION FREQUENCY ON A NUMERICAL MODEL OF NEAR-SURFACE ICE SEGREGATION,
Michigan Univ., Ann Arbor. Dept. of Geography.
For primary bibliographic entry see Field 2C.
W80-01506

CRYOGENIC TEXTURE AND STRENGTH ASPECTS OF ARTIFICALLY FROZEN SOILS,
Rutgers-The State Univ., New Brunswick, NJ. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2C.
W80-01507

PREDICTION OF SALT INFLUENCE ON UNFROZEN WATER CONTENT IN FROZEN SOILS,
McGill Univ., Montreal (Quebec). Geotechnical Research Centre.
For primary bibliographic entry see Field 2C.
W80-01508

UNFROZEN WATER AS A FUNCTION OF CLAY MICROSTRUCTURE,
Lulea Univ. (Sweden). Div. of Soil Mechanics.
For primary bibliographic entry see Field 2C.
W80-01509

INTERRELATIONSHIP OF THE PRINCIPAL PHYSIOCOMECHANICAL AND THERMOPHYSICAL PROPERTIES OF COARSE-GRAINED FROZEN SOILS,
Kuybyshevskii Inzhenero-Stroitelnyi Inst. (USSR). Frozen Soil Science and Power Plant Construction Branch Research Lab.
For primary bibliographic entry see Field 2C.
W80-01510

EFFECT OF FREEZE-THAW CYCLES ON RESILIENT PROPERTIES OF FINE-GRAINED SOILS,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 2C.
W80-01517

PRESSURE OF THAWING SOILS ON THE CONCRETE LINING OF VERTICAL MINE SHAFTS,
Research Inst. of Bases and Underground Structures, Gosstroi (USSR).
For primary bibliographic entry see Field 2C.
W80-01518

THERMAL AND RHEOLOGICAL COMPUTATIONS FOR ARTIFICALLY FROZEN GROUND CONSTRUCTION,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 2C.
W80-01521

STABILITY OF MINE WORKINGS IN FROZEN SOILS,
Research Inst. of Bases and Underground Structures, Gosstroi (USSR).
For primary bibliographic entry see Field 2C.
W80-01522

STRENGTH ANALYSIS OF THE FROZEN-GROUND ENCLOSURE OF A LOW-TERMPERATURE STORAGE RESERVOIR FOR LIQUEFIED GASES,
All-Union Research Inst. for the Utilization of Gas in the Economy and for the Underground Storage of Oil, Oil Products and Liquefied Gases, Moscow, (USSR).
For primary bibliographic entry see Field 8D.
W80-01524

DESIGN OF TUNNEL SUPPORT SYSTEMS USING GROUND FREEZING,
Law Engineering Testing Co., McLean, VA.
J. S. Jones, and R. E. Brown.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 375-395, April 1979. 10 Fig, 2 Tab, 25 Ref.

Descriptors: *Frozen soils, *Tunneling, *Frost heaving, *Tunnel construction, Freezing, Frozen ground, Laboratoty tests, Methodology, Mechanical properties, Stress analysis, Creep, Analytical techniques, Finite element analysis, Tunnel linings, Stress, Strain, Triaxial tests.

This paper described the general design considerations involved in the ground-freezing method. Various factors were discussed which influence the selection of the freezing temperature, the thickness of the frozen zones and the spacing of the freeze pipes. The time required to achieve freezing was discussed in addition to the amount and rate of frost heave caused by the freezing. To illustrate the applicability of the freezing method, varous considerations in the design of an 8-ft diameter tunnel in upstate New York, a 75-ft diameter tunnel in Georgia, and a 12.5-ft diameter tunnel in Washington, D.C., were discussed. The tunnels were to pass immediately beneath mainline railroad tracks. A laboratory testing program was implemented to determine the effects of the repetitive train loads on the zone of frozen soil around the tunnel perimeter. Stress-controlled repeated load triaxial tests were performed on both undisturbed and remolded samples frozen from temperatures of -7C for the New York tunnel to -10C for the Atlanta and Washington tunnels. It was found that there was little difference between the cumulative strain response from repeated load tests and static tests for the low frequencies investigated (1/4 to 1/2 cycles per minute). Hyperbolic stress-strain functions were developed to simulate the stress-strain relationship for various cummulative loading times. The stresses and strains in the frozen soil tunnel configuration were computed by the finite element method, using both linear and hyperbolic stress-strain functions. The analyses indicated that zones of frozen soil of approximately 3 ft thick were required for both the New York and Washington tunnels. However, high tensile stresses were calculated for the Atlanta tunnel, precluding the use of the freezing method. (See also W80-01498) (Humphreys-ISWS)
W80-01525

LARGE-SCALE FREEZING WORK FOR SUBWAY CONSTRUCTION IN JAPAN,
Tokyo Metropolitan Government (Japan).
For primary bibliographic entry see Field 8A.
W80-01526

THE SOIL-FREEZING METHOD FOR LARGE TUNNEL CONSTRUCTIONS,
Holzmann (Phillip) A. G., Frankfurt am Main (Germany, F.R.).
For primary bibliographic entry see Field 8A.
W80-01527

SUBWAY CONSTRUCTION IN STUTTGART UNDER PROTECTION OF A FROZEN SOIL ROOF,
Holzmann (Phillip) A. G. , Frankfurt am Main (Germany, F. R.).
For primary bibliographic entry see Field 8A.
W80-01528 .

GROUND FREEZING FOR SUPPORT OF OPEN EXCAVATIONS,
Terrafreeze Corp., Lorton, VA.
B. Braun, J. Shuster, and E. Burnham.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 429-453, April 1979. 7 Fig, 27 Ref.

Descriptors: *Frozen ground, *Excavations, *Construction, Freezing, Frozen soils, Refrigeration, Methodology, Monitoring, Design criteria, Costs, Groundwater, Sites, Equipment, Geology, Hydrology, Groundwater control, Refrigeration plants.

A practical discussion of critical factors for designing and constructing temporary frozen earth ground support and groundwater control systems for large open excavations was reported. Many construction projects require extensive subsurface work which can best be completed in a large open excavation, shaped to accommodate the subsurface structure. Frequently, lateral ground support of adjoining property and groundwater control within the excavation are major problems for completion of subsurface work. Construction ground freezing has now become an economically competitive solution for many such applications, particularly in bad ground. The general experience gained from completing ground freezing for numerous open excavation projects over the past 10 years was reported to assist in the evaluation, design, and construction of future projects. The principal emphasis of this report was the practical construction and field instrumentation procedures necessary successfully to complete ground freezing for a project. Examples from past projects ranging from large nuclear power plants to small sewerage pumping stations were employed to emphasize important points. (See also W80-01498) (Humphreys-ISWS)
W80-01529

GROUND FREEZING MONITORING TECHNIQUES,
International Versuchsanstalt for fuer Fels G.m.b.H., Bentheim (Germany, F.R.). Interfels.
D. Heinrich, G. Muller, and H. Voort.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 455-471, April 1979. 13 Fig, 1 Tab, 2 Ref.

Descriptors: *Frozen soils, *Monitoring, *Boreholes, *Logging(Recording), Instrumentation, Frozen ground, Frost heaving, Frost, Freezing,

Methodology, On-site tests, Measurement, Soil temperature, Temperature control, Surveys, Coolants, Vertical boreholes, Horizontal boreholes, Inclinometers.

Ground-freezing is used in mining and civil engineering to make water-bearing strata temporarily impermeable and to increase their compressive and shear strength by transforming joint water and interstitial water into ice. Freezing of rock or soil layers is achieved by means of an array of cased boreholes, through which a cold liquid is circulated in order to remove heat energy, comparable to cooling coils. Frost expansion from the boreholes into the ground is monitored for a better and more economic control of the freezing process. For this purpose, instruments for the determination of borehole deviation, for measurement of the temperature field, and for an assessment of the degree of freezing with ultrasonic waves have proved useful. These three techniques were described based on results obtained from field measurements. (See also W80-01498) (Humphreys-ISWS)
W80-01530

GROUND CONSOLIDATION WITH LIQUID NITROGEN (LN2),
Linde A.G., Hollriegelskreuth (Germany, F.R.). Technical Gases Div.
For primary bibliographic entry see Field 2C.
W80-01531

USES AND LIMITATIONS OF GROUND FREEZING WITH LIQUID NITROGEN,
Deilmann-Haniel G.m.b.H., Dortmund (Germany, F.R.).
For primary bibliographic entry see Field 2C.
W80-01532

JOINTING OF TWO TUNNEL SHIELDS USING ARTIFICIAL UNDERGROUND FREEZING,
Seiken Co., Ltd. Osaka (Japan).
T. Takashi, S. Kiriyama, and T. Kato.
In: Ground Feeezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 519-529, April 1979. 12 Fig.

Descriptors: *Tunneling, *Frozen soils, *Underground structures, *Freezing, Tunnel construction, Frozen ground, Methodology, On-site investigations, Sewers, Temperature control, Frost heaving, Soil temperature, Foreign countries, Sands, Brines, *Japan.

Freezing was used in the jointing section of two shields (diameter 3.14 m) which ran across at right angles and at 25-m depth under the crossing of main roads for construction of a 2.4-m diameter sewer tunnel. The object of freezing was to create a frozen barrier to prevent the inflow of water and fine sand into the area to be excavated. Thirty-five freeze pipes (length about 7 m) were placed from one shield conically in the direction of the flank of another shield with freeze pipes attached to its inside wall. The cooling unit was placed on unoccupied land at abourt 60 m distant from the jointing section, and the freeze pipes were connected with the cooling unit by supply and return pipelines. The cooling unit had a cooling capacity of 79,000 kcal/h at an evaporation temperature of -27C and a condensation temperature of 40C. Freezing was continued for 180 days, and the CaCl2 brine temperature was -25 to -30C. These works were accomplished without the sinking of shaft and the use of injection, in complete safety with no traffic restriction on the road surface. (See also W80-01498) (Humphreys-ISWS)
W80-01535

CONVERSION OF ABANDONED COLLIERIES IN SOUTHERN BELGIUM INTO LOW-PRESSURE GAS STORAGE UNITS, WITH DESCRIPTION OF SPECIAL PLUGGING OF THE VARIOUS SHAFTS,
N. V. Foraky SA., Brussels (Belgium).
E. F. J. Buttiens.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 531-539, April 1979. 3 Fig.

Descriptors: *Underground storage, *Frozen soils, *Coal mines, Mining, Shafts(Excavations), Construction, Freezing, Foreign countries, On-site investigations, Underground structures, Frozen ground, *Shaft closure, *Belgium, Gas storage, Abandoned shafts.

In the southern part of Belgium, in the province of Hainaut, several collieries have been dismantled and closed over the last 10 years. Geological conditions in this part of the country are advantageous for the construction of large storage units in the mine galleries which remained open. It is, therefore, necessary to evaluate this possibility, and also to plug the old mine shafts. The construction of gastight shaft-plugs able to withstand demolition charges was carried out with maximum safety precautions by artificially freezing the roof and floor above and beneath the plug. The application of this unique method in the concession of 'Bois de la Haye' was described. (See also W80-01498) (Humphreys-ISWS)
W80-01536

APPLICATION OF THE GROUND-FREEZING METHOD TO PENETRATE A SEQUENCE OF WATER-BEARING AND DRY FORMATIONS--THREE CONSTRUCTION CASES,
Thyssen Schachtbau G.m.b.H., Mulheim an der Ruhr (Germany, F.R.).
E. Rupprecht.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 541-546, April 1979. 3 Fig.

Descriptors: *Tunneling, *Adits, *Frozen soils, *Porous media, Construction, Boreholes, Saturated soils, Groundwater, Aquifers, Underground structures, Freezing, Methodology, Geology.

In large areas of the world, adits to underground caverns, mineral deposits, and other openings have to penetrate a sequence from surface to final depth of sweet-water-bearing ground, dry consolidated ground, and salt-water-bearing ground. The pressure of the salt water is approximately equal to the full hydrostatic head to surface. Contamination of the upper sweet water reservoir by the salt water is to be avoided during construction work and also after completion. Three construction cases were presented using different methods as follows: Case 1: The top formation is penetrated using the ground-freezing method; the dry formation is penetrated conventionally; and the salt-water-bearing formation is penetrated using the ground-freezing method. Special problem: Drilling freeze holes from a station in the dry formation into the high-pressure salt-water-bearing formation. Case 2: The entire sequence is penetrated using the ground-freezing method. Special problem: Abandonment of freeze holes to prevent salt-water migration from the lower aquifer to the sweet-water aquifer. Case 3: Freeze holes are drilled from surface and freeze pipes are set in the lower salt-water-bearing strata only; the top water-bearing formation is penetrated, using a dewatering system; the dry formation is penetrated conventionally; and the lower salt-water-bearing formation is penetrated using the ground-freezing method. Special problem: Installation of freeze pipes and preabandonment. (See also W80-01498) (Humphreys-ISWS)
W80-01537

DETERMINISTIC HYDROLOGIC MODELING OF GRAZING SYSTEM IMPACTS ON INFILTRATION RATES,
Utah State Univ., Logan. Watershed Science Unit.
G. F. Gifford, and R. H. Hawkins.
Water Resources Bulletin, Vol 15, No 4, p 924-934, August 1979. OWRT A-035-UTAH (3), 14-34-0001-8047.

Descriptors: *Infiltration rates, *Grazing, *Hydrologic aspects, *Forages, *Pasture management, Infiltration, Cattle, Sheep, Pastures, Ecology, Environmental effects, Grasslands.

The available literature on the effect of grazing intensity on infiltration rates was used as a basis for modeling the response of infiltration to grazing systems. Linear equations were developed relating infiltration rates to the grazing intensity and time. An example was included to demonstrate the use and limitations of the method. (Adams-ISWS)
W80-01544

2H. Lakes

POND LITTORAL ECOSYSTEMS
Springer-Verlag, Berlin, Heidelberg, New York, 1978. 464 p, 183 Fig. Dykyjova, D. Ind Kvet, J., (eds).

Descriptors: *Freshwater marshes, *Littoral, *Ecosystems, Wetlands, Ponds, Marsh plants, Marsh management, Wildlife, Productivity, Decomposing organic matter, Nutrients, Biological communities, Conversation, *Czechoslovakia.

This fishpond littoral ecosystems were investigated in two biogeographical regions in Central Europe with a comparison between the environmental characteristics and functioning of the biotic components in the Trebon Basin (a reserve in Bohemia) and in the Lednice fishponds (a nature reserve in Moravia). Information includes structure, productivity, and production processes of the vegetation and its macrophytes and algae, decomposition processes and mineral nutrient regime in fishpond littorals, the role of certain animal populations, and management and conversation of fishpond littoral vegetation and waterfowl. (See W80-01210 thru W80-01251) (Steiner-Mass)
W80-01209

INTRODUCTION TO THE ECOLOGY OF FISHPOND LITTORALS,
Ceskoslovenska Akademie Ved, Brno. Botanicky Ustav.
S. Hejny, and J. Kvet.
In: Pond Littoral Ecosystems: Springer-Verlag, New York, p 1-9, 1978. 2 Fig, 15 Ref.

Descriptors: *Farm ponds, *Ecology, Wetlands, Lakes, Water levels, Ponds, Fish farming, Impounded waters, Ecosystems.

By contrast to natural standing waters, a fishpond is a man-made complex ecosystem. As fishponds have mainly been constructed in wetland regions, their biotic communities do not differ substantially from those of the original natural wetland. A specific feature of fishponds is the possibility to drain or fill them up at any time if enough water is available. The actual position of the water level determines that distribution of ecophases along the bottom slope. The ecophases are to a large extent compatible with the frequently used limnological terms denoting zones of the littoral, as derived from the zonation observed on lake shores. (See also W80-01209) (Steiner-Mass)
W80-01210

GENERAL CHARACTERISTICS OF THE TREBON BASIN AND LEDNICE REGION,
Ceskoslovenska Akademie Ved, Brno. Botanicky Ustav.
S. Husak, and S. Hejny.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 13-22, 1978. 5 Fig, 3 Tab.

Descriptors: *Farm ponds, *Geomorphology, *Ecology, Wetlands, Ponds, Fish farming, Impounded waters.

The Trebon Basin, originally an inaccessible wetland area, has been developed into a region of fish culture and forest plantations. The fishponds are filled with a naturally dystrophic water originating from large peatbogs. This water becomes highly eutrophicated through fertilization and manuring both of the fishpond water and surrounding cultivated land. In the Lednice region, the wetland is

abundant and constant. Water is supplied to the main Lednice fishponds by two brooks and by several smaller streams which usually dry out in the summer. There is no large stream in the area that would permanently ensure a sufficient water supply to these fish-ponds. They therefore often lack water. (See also W80-01209) (Steiner-Mass)
W80-01211

HIGHER PLANT COMMUNITIES,
Ceskoslovenska Akademie Ved Botanicky Ustav.
For primary bibliographic entry see Field 2I.
W80-01212

ALGAL POPULATIONS RELATED TO DIFFERENT MACROPHYTE COMMUNITIES,
Ceskoslovenska Akademie Ved, Brno. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01213

AERIAL PHOTOGRAPHY AND MAPPING OF FISHPOND VEGETATION,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2I.
W80-01214

ANIMAL POPULATIONS IN FISHPOND LITTORALS,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
For primary bibliographic entry see Field 2I.
W80-01215

DECOMPOSERS IN THE FISHPOND LITTORAL ECOSYSTEM,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2I.
W80-01216

DEVELOPMENT OF WETLAND AND AQUATIC VEGETATION IN THE TREBON BASIN SINCE THE LATE GLACIAL PERIOD,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2I.
W80-01217

MICROCLIMATE IN FISHPOND LITTORAL ECOSYSTEMS,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
P. Smid, and K. Priban.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 104-112, 1978. 4 Fig, 4 Tab.

Descriptors: *Farm ponds, *Littoral, *Microclimatology, *Environmental effects, Wetlands, Aquatic habitats, Decomposing organic matter, Microenvironment, Temperature, Marsh plants, Ecosystems.

The main factor influencing the microclimatic conditions in these communities is the presence of large amounts of living and/or dead plant mass, with the winter-cut stands in spring forming an exception. A thick layer of litter usually insulates thermally the deeper-situated bottom soil. This insulating effect is more pronounced in the terrestrial and limosal ecophases, when the litter is not flooded and is only partly saturated with water. The reduction of incoming radiation by a fully developed vegetative canopy usually makes the water cool in the reed belt in summer. These cool conditions reduce the rate of organic matter decomposition. In spring, the littoral microclimate appears to be relatively the most favorable of the whole fishpond. The increased water and bottom temperatures promote rapid plant growth. The microclimate within the canopies depends primarily on the ratio of dead to living plant material, which changes in the course of a year. (See also W80-01209) (Steiner-Mass)
W80-01218

RADIATION CLIMATE IN FISHPOND LITTORAL PLANT COMMUNITIES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01219

WATER CHEMISTRY IN THE FISHPOND LITTORALS,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2K.
W80-01220

STRUCTURE AND CHEMISTRY OF THE FISHPOND BOTTOM,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2G.
W80-01221

INTRASPECIFIC AND CLONAL VARIABILITY AND ITS IMPORTANCE FOR PRODUCTION ESTIMATES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01222

SELECTION OF SAMPLING AREAS IN ASSESSMENT OF PRODUCTION,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 7B.
W80-01223

SEASONAL DEVELOPMENT OF HELOPHYTE POLYCORMONES AND RELATIONSHIP BETWEEN UNDERGROUND AND ABOVEGROUND ORGANS,
Ceskoslovenska Akademie Ved, Brno. Botanicka Ustav.
For primary bibliographic entry see Field 2I.
W80-01224

ESTIMATION OF SEASONAL GROWTH OF UNDERGROUND BIOMASS,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01226

GROWTH ANALYSIS OF FISHPOND LITTORAL COMMUNITIES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01227

COMMUNITIES OF EMERGED FISHPOND SHORES AND BOTTOMS,
Ceskoslovenska Akademie Ved, Prague. Inst. of Entomology.
For primary bibliographic entry see Field 2I.
W80-01228

PRIMARY DATA ON BIOMASS AND PRODUCTION ESTIMATES IN TYPICAL STANDS OF FISHPOND LITTORAL PLANT COMMUNITIES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01229

DETERMINATION OF ENERGY CONTENT AND NET EFFICIENCY OF SOLAR ENERGY CONVERSION BY FISHPOND HELOPHYTES,
Ceskoslovenska Akademie Ved, Trebon. Dept. Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01230

ESTIMATION OF NET PHOTOSYNTHETIC EFFICIENCY FROM GROWTH ANALYTICAL DATA,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01231

NET PHOTOSYNTHESIS AND DARK RESPIRATION OF REED ESTIMATED BY GAS-EXCHANGE MEASUREMENTS,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2I.
W80-01232

MODELING OF PHOTOSYNTHETIC PRODUCTION IN LITTORAL HELOPHYTE STANDS,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01233

WATER RELATIONS, WATER BALANCE, TRANSPORATION, AND WATER TURNOVER IN SELECTED REEDSWAMP COMMUNITIES,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2I.
W80-01234

NUTRIENT UPTAKE BY LITTORAL COMMUNITIES OF HELOPHYTES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01235

GROWTH, PRODUCTION AND NUTRIENT UPTAKE OF DUCKWEEDS IN FISHPONDS AND IN EXPERIMENTAL CULTURES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01236

STRUCTURAL ELEMENTS. PRINCIPAL POPULATIONS OF ALGAE. SPATIAL DISTRIBUTION.
Ceskoslovenska Akademie Ved, Brno. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01237

DYNAMICS OF ALGAL COMMUNITIES,
Ceskoslovenska Akademie Ved, Brno. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01238

PRIMARY PRODUCTION AND FUNCTIONING OF ALGAE IN THE FISHPOND LITTORAL,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2I.
W80-01239

DECOMPOSITION PROCESSES IN THE FISHPOND LITTORAL,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
For primary bibliographic entry see Field 2I.
W80-01240

MAMMALS IN THE REEDSWAMP ECOSYSTEM,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
For primary bibliographic entry see Field 2I.
W80-01241

BIRDS IN THE REEDSWAMP ECOSYSTEM,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
For primary bibliographic entry see Field 2I.
W80-01242

SOIL SURFACE ARTHROPODS,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
For primary bibliographic entry see Field 2I.
W80-01243

INVERTEBRATES: DESTROYERS OF COMMON REED,
Ceskoslovenska Akademie Ved, Prague. Inst. of Entomology.
For primary bibliographic entry see Field 2I.
W80-01244

MACROFAUNA OF INVERTEBRATES IN HELOPHYTE COMMUNITIES,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
For primary bibliographic entry see Field 2I.
W80-01245

MANAGEMENT ASPECTS OF FISHPOND DRAINAGE,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
For primary bibliographic entry see Field 6G.
W80-01246

CONTROL OF REED AND REED MACE STANDS BY CUTTING,
Ceskoslovenska Akademie Ved. Prague. Botanicky Ustav.
For primary bibliographic entry see Field 2I.
W80-01247

ECOLOGICAL EFFECTS OF FISHPOND AMELIORATION,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
For primary bibliographic entry see Field 6G.
W80-01248

PROPAGATION, CULTIVATION AND EXPLOITATION OF COMMON REED IN CZECHOSLOVAKIA,
Ceskoslovenska Akademie Ved, Trebon. Inst. of Microbiology.
For primary bibliographic entry see Field 2I.
W80-01249

CONSERVATION OF PLANT COMMUNITIES IN FISHPOND LITTORALS,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
S. Hejny.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 429-433, 1978. 1 Fig, 2 Tab.

Descriptors: *Freshwater marshes, *Conservation, *Czechoslovakia, Wetlands, Marshes, Marsh plants, Ponds, Littorals, Marsh management.

In Czechoslovak fishponds, the vegetation of aquatic vascular plants has been changing rapidly during the last twenty years because of the combined effects of intense fertilizing and manuring, duck-farming, and mechanical amelioration. The basically correct concept of rational control of macrophytes should therefore be replaced by a regulation of macrophyte development, combined with conservation. The conservation aspect is particularly important because the ponds still contain the largest pool of macrophyte species populations and communities in Central Europe--though somewhat altered. Most alluvial wetland habitats, by contrast, have been changed irreversibly or destroyed completely. (See also W80-01209) (Steiner-Mass)
W80-01250

CONSERVATION OF WILDFOWL IN FISHPOND REGIONS,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
For primary bibliographic entry see Field 2I.
W80-01251

MODIFICATIONS TO THE MACKERETH CORER,
Australian National Univ., Canberra (Australia). Research School of Earth Sciences.
For primary bibliographic entry see Field 2J.
W80-01268

A CLOSE-INTERVAL WATER SAMPLER WITH MINIMAL DISTURBANCE PROPERTIES,
Oslo Univ. (Norway).
For primary bibliographic entry see Field 7B.
W80-01269

A DURABLE, RESUABLE ENCLOSURE SYSTEM THAT COMPENSATES FOR CHANGING WATER LEVELS,
Indiana Univ. at Bloomington. Dept. of Biology.
For primary bibliographic entry see Field 7B.
W80-01271

THE REMOVAL OF ORGANIC SURFACE FILMS BY RAIN,
Wisconsin Univ. Madison. Dept. of Civil and Environmental Engineering.
T. Green, and D. F. Houk.
Limnology and Oceanography, Vol 24, No 5, p 966-970, September 1979. OWRT B-060-WIS (2), 14-31-0001-3666.

Descriptors: *Monomolecular films, *Rain , *Organic compounds, Laboratory tests, Surface tension, Hexadecanol, Raindrops, Bubbles, Effects, Interfaces, Lakes, Film removal, Organic films.

Laboratory experiments suggested that natural rainfall can remove organic surface films from a water surface in minutes, or tens of minutes. The remove rate varies with raindrop size and seems to be associated with breaking bubbles, in turn due to the rain. (Sims-ISWS)
W80-01543

BIBLIOGRAPHY OF ENVIRONMENTAL STUDIES ON LAKE CHAMPLAIN,
Lake Champlain Basin Study, New England River Basins Commission, Burlington, Vermont; August, 1978. 53 p, Prepared by Paul R. Vachon.

Descriptors: *Bibliographies, *Lake Champlain, *Environment, Aquatic life, Aquatic plants, Benthos, Erosion, Flooding, Fisheries, Limnology, Planning, Resource development, Sedimentology, Water pollution, Water quality, Weather, Wetlands, Wildlife.

The bibliography lists and describes the nature of selected past and current environmental studies relevant to Lake Champlain and its drainage basin. Bibliographic categories include: aquatic life, aquatic plants, benthos, erosion, fisheries, flooding, limnology, planning, resource management, sedimentology, water pollution, water quality, weather, wetlands, and wildlife. (Steiner-Mass)
W80-01581

ENVIRONMENTAL FEATURES, GENERAL HYDROLOGY, AND EXTERNAL SOURCES OF NUTRIENTS AFFECTING WILDERNESS LAKE, KING COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
N. P. Dion.
Geological Survey Water-Resources Investigations 79-63 (open-file report), 1979. 27 p, 8 Fig, 3 Tab, 17 Ref.

Descriptors: *Lakes, *Hydrology, *Environmental effects, Hydrologic budget, *Eutrophication, Nutrients, Hydrogeology, Inflow, Discharge(Water), Septic tanks, Water quality, Washington, *Wilderness Lake(Wash), King County(Wash).

A water budget prepared for Wilderness Lake, a candidate for lake-quality restoration, indicates that of the 530 acre-feet of water that enters the lake each year, 170 acre-feet is from precipitation and 360 acre-feet is from groundwater inflow. An equal amount leaves the lake, and of this, 380 acre-feet is by surface runoff, 8 acre-feet is by groundwater seepage, and 140 acre-feet is by evaporation. Based on these amounts of inflow and outflow, the theoretical water-renewal time of the lake is calculated to be 2.6 years. The annual contributions of nitrogen and phosphorus to the lake from precipitation, natural ground water, and septic-tank leachate are about 920 kilograms nitrogen and 38 kilograms phosphorus. Nitrogen and phosphorus contributions from other sources were not assessed but could be significant. (Woodard-USGS)
W80-01595

2I. Water In Plants

POND LITTORAL ECOSYSTEMS
For primary bibliographic entry see Field 2H.
W80-01209

HIGHER PLANT COMMUNITIES,
Ceskoslovenska Akademie Ved Botanicky Ustav.
S. Hejny, and S. Husak.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 23-64, 1978. 6 Fig, 3 Tab.

Descriptors: *Farm ponds, *Marsh plants, *Plant groupings, Wetlands, Lakes, Impounded waters, Survey, Aquatic plants, Biological communities, Distribution patterns, Census, *Czechoslovakia.

A survey is given of the vascular plant communities occurring in fishponds and in their littorals in the two regions studied within the Czechoslovak IBP Wetlands project; namely, in South Bohemia and South Moravia. Stress is laid on the general ecological characteristics of these communities classified into associations which are, in turn, grouped into foederations (alliances) as the nearest higher-ranking units according to the principles of the Zurich-Montpellier school of vegetation classification. (See also W80-01209) (Steiner-Mass)
W80-01212

ALGAL POPULATIONS RELATED TO DIFFERENT MACROPHYTE COMMUNITIES,
Ceskoslovenska Akademie Ved, Brno. Dept. of Hydrobotany.
P. Marvan, and J. Komarek.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 65-70, 1978. 1 Tab.

Descriptors: *Farm ponds, *Marsh plants, *Algae, Wetlands, Lakes, Sessile algae, Biological communities, Distribution patterns, *Czechoslovakia.

Characteristics and comparisons are given of the species composition in individual microphyte synusia associated with principle macrophyte communities. The basic data originate from the Opatovicky fishpond, Czechoslovakia, and are completed by further observations on the Nesyt fishpond, Czechoslovakia. (See also W80-01209) (Steiner-Mass)
W80-01213

AERIAL PHOTOGRAPHY AND MAPPING OF FISHPOND VEGETATION,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
P. Smid.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 71-73, 1978. 1 Fig.

Descriptors: *Farm ponds, *Marsh plants, *Aerial photography, Wetlands, Lakes, Distribution patterns, Succession, Mapping, Marsh management.

The mapping of the fishpond vegetation in the Czechoslovak IBP Wetland project served a two

fold purpose: (1) estimation of the areas covered by stands of different vegetation types, which might also serve as production types, and (2) documentation of different stages of development of the littoral vegetation and of its changes under various kinds of influence. The aerial photographs permit an examination of the long-term spreading of the stands, of their succession, as well as their seasonal development. (See also W80-01209) (Steiner-Mass)
W80-01214

ANIMAL POPULATIONS IN FISHPOND LITTORALS,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
J. Pelikan, K. Hudec, and K. Stastny.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 74-79, 1978. 2 Fig, 2 Tab.

Descriptors: *Aquatic animals, *Farm ponds, Wetlands, Aquatic habitats, Wildlife habitat, Wildlife, Birds, Aquatic insects, Biological communities, *Czechoslovakia.

Rather varied biotypes frequently coexist in a fishpond and its surroundings. This is particularly true of large fishpond systems with their dams and interconnecting canals and ditches. The variety of biotopes is reflected in a corresponding variety of animal populations living together in a relatively small area but occupying different niches. A two-years' survey of the set of bird populations living on and along the dams fringing the flood plain of the ancient Nova Reka canal passing through a wooded and fishpond-rich part of the Trebon basi, Czechoslovakia, has detected altogether 60 species populations. (See also W80-01209) (Steiner-Mass)
W80-01215

DECOMPOSERS IN THE FISHPOND LITTORAL ECOSYSTEM,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
B. Ulehlova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 80-87, 1978. 3 Fig, 5 Tab.

Descriptors: *Marsh plants, *Decomposing organic matter, *Aquatic microorganisms, Wetlands, Cattails, Littoral, Detritus, Deterioration.

Observations and experiments were performed to evaluate the numbers and composition of microflora associatted with different stages of decomposition of dead plant remnants, particularly those of Phragmites communis and Typha angustifolia. Standing dead Typha is much more densely colonized than standing dead Phragmites (on dry weight basis). Both kinds of dead material collected in aquatic habitats yield higher counts of microflora than those from terrestrial habitats. The differences between terrestrial and aquatic habitats are particularly pronounced in the case of Typha. Approximately one million microorganisms exist in one gram of dry standing dead material of littoral helophytes. The moisture of the standing dead material may differ considerably with habitat, which may control the counts of microorganisms. (See also W80-01209) (Steiner-Mass)
W80-01216

DEVELOPMENT OF WETLAND AND AQUATIC VEGETATION IN THE TREBON BASIN SINCE THE LATE GLACIAL PERIOD,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
V. Jankovska.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 88-92, 1978. 2 Fig.

Descriptors: *Marsh plants, *Geologic mapping, Wetlands, Peat, Palynology, Bogs, Stratification, Stratigraphy, Marshes, Swamps.

From the analyses of peatbog profiles, it was concluded that aquatic and wetland communities related to the present foederationes Potamion and Nymphaeion have been present in the Trebon basin since the late glacial period. Typha latifolia and Phragmites communis appeared probably during the Pre-boreal period and reedswamp communities developed fully during the Boreal period. Alder swamp forest has presumably been present since the Early Atlantic. (See also W80-01209) (Steiner-Mass)
W80-01217

RADIATION CLIMATE IN FISHPOND LITTORAL PLANT COMMUNITIES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. P. Ondok.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 113-125, 1978. 9 Fig, 4 Tab.

Descriptors: *Light, *Distribution patterns, *Marsh plants, Wetlands, Littoral, Radiation, Microclimatology, Microenvironment, Plant growth, Seasonal, Photosynthesis.

The penetration of radiation into a stand depends on a number of factors, among which stand geometry, canopy density, and wind conditions are the most important for the extinction of both direct and diffuse radiation. The flux of scattered radiation is mainly affected by optical properties of the leaves. Most of the stands examined such as Typha angustifolia, Typha latifolia, Acorus calamus, and Sparganium erectum, possess a more or less erectophile foliage, which enables the radiation to penetrate quite deep into their stands. Most of their young and physiologically active assimilatory tissues are located in the lower canopy layers and the deeply penetrating radiation is used for their photosynthesis. In Phragmites communis and Glyceria maxima, the youngest leaves are concentrated in the higher canopy layers. Their successive leaves grow on the stems and acquire, on the average, a near-horizontal position. (See also W80-01209) (Steiner-Mass)
W80-01219

INTRASPECIFIC AND CLONAL VARIABILITY AND ITS IMPORTANCE FOR PRODUCTION ESTIMATES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
D. Dykyjova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 159-163, 1978. 2 Fig, 1 Tab.

Descriptors: *Marsh plants, *Plant populations, *Variability, Wetlands, Freshwater marshes, Littoral, Productivity, Plant morphology, Genetics, Shape, Heterogeneity, Cattails.

Littoral stands of emergent macrophytes especially reed-bed stands, present relatively simple natural communities in which the population of the ecotype is the dominant component of the community. Phragmites communis is the most polymorphous and widespread species, growing uniform clonal populations in the variable littoral habitats. In its pure stands, it is possible to measure the variability of biomass production of one Phragmites clone, extended over an area within which there is large variation in edaphic and microclimatic conditions. Observations made so far seem to imply that the differences in the morphology of Phragmites from different regions could partly be explained on plant-geographical grounds. The other dominant reed-belt species appear to be as variable as the common reed. Typha angustifolia, displaying in many cases a very high production, inclines to hybridization with Typha latifolia. It is possible that some of the highly productive stands that were found, composed predominantly of sterile polycormones, were hybrids exhibiting a heterosis effect. (See also W80-01209) (Steiner-Mass)
W80-01222

SEASONAL DEVELOPMENT OF HELOPHYTE POLYCORMONES AND RELATIONSHIP BETWEEN UNDERGROUND AND ABOVEGROUND ORGANS,
Ceskoslovenska Akademie Ved, Brno. Botanicka Ustav.
K. Fiala.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 174-181, 1978. 6 Fig.

Descriptors: *Marsh plants, *Cattails, *Biomass, *Plant growth, *Root development, Wetlands, Freshwater marshes, Ponds, Littoral, Productivity, Standing crops, Seasonal, Rhizomes, Root systems.

The seasonal development of Typha polycormones may be approximately divided into four successive periods: (1) End of April to May: mobilization of reserve materials and development of the photosynthetic apparatus linked with a rapidly decreasing root-shoot ratio, (2) June: termination of, or a slow-down in the uptake of reserve substances from the rhizomes, continuing increase in aboveground biomass, appearance of the flowering shoots, the first off-shooting and growth of new underground organs; persistence in a marked decrease in the root/shoot ratio, (3) July to August: maximum development of the photosynthetic apparatus, formation of numerous offshoots, high increase in underground biomass; relative stabilization of the root-shoot ratio, (4) September to November: termination of the development of the photosynthetic apparatus, decrease in aboveground biomass, intense formation of offshoots and hibernating buds, accumulation of reserve substances in underground organs linked with an increase in the root/shoot ratio. (See also W80-01209) (Steiner-Mass)
W80-01224

EXPERIMENTAL HYDROPONIC CULTIVATION OF HELOPHYTES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
D. Dykyjova, and K. Veber.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 181-192, 1978. 8 Fig, 2 Tab.

Descriptors: *Marsh plants, *Hydroponics, Wetlands, Plant growth, Cattails, Aquiculture, Marsh management, Cultivation, Freshwater marshes, Planting management, Vegetation establishment.

In experiments with different planting dates, outstanding symptoms of thermoperiodism and dormancy were found in all species investigated. All plants which developed from cuttings planted out in November were small as a result of an uncompleted bud-break period. This effect was more pronounced in the warmer greenhouse conditions and did not disappear even during the later spring. Typha latifolia shoots started from cuttings stored at low temperatures and planted out in January attained the same shoot height and density as those in natural stands. Phragmites plants started as one-year-old seedlings attained a high density during the spring months as well. Typha angustifolia requires a very high irradiance. It developed very slowly in the winter cultures as compared with the summer outdoor hydroponics, and produced only few lateral shoots even after termination of its bud break. Schoenoplectus lacustris and Acorus calamus developed better in a cooler environment, 13 to 15C, but they became easily etiolated at a low irradiance in warmer conditions. (See also W80-01209) (Steiner-Mass)
W80-01225

ESTIMATION OF SEASONAL GROWTH OF UNDERGROUND BIOMASS,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. P. Ondok.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 193-197, 1978. 4 Fig, 1 Tab.

Descriptors: *Marsh plants, *Root systems, *Estimation, Wetlands, Leaves, Freshwater marshes, Standing crops, Marshes, Roots, Biomass, Plant growth.

Spring translocation can be estimated from the growth rate of leaf area and aboveground biomass. The time-lag of leaf growth of marsh plants controls the amount of material translocated from the reserves to the aerial organs; the ratio of the growth rate of leaf area to that of aboveground biomass determines the final ratio of underground to aboveground production. (See also W80-01209) (Steiner-Mass)
W80-01226

GROWTH ANALYSIS OF FISHPOND LITTORAL COMMUNITIES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. Kvet.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 198-206, 1978. 6 Fig, 2 Tab.

Descriptors: *Marsh plants, *Plant growth, Wetlands, Ponds, Freshwater marshes, Littoral, Biological communities, Productivity, Cattails, *Czechoslovakia.

Growth analysis was used on the primary production of pond littoral vascular plants and their communities as a tool for evaluating the seasonal dynamics of their net production and vertical productive structure. The seasonal dynamics of aboveground net production were studied in almost monospecific stands formed by most of the dominants of the various associations belonging to the foederatio Phragmition communis. Growth analysis studies were also made in stands of pure Bolboschoenus maritimus and in Caricetum gracilis. The studies were undertaken in both South Bohemia and South Morovia (Czechoslovakia) fishpond and marshes. Growth analysis of complete polycormones of Typha angustifolia, Typha latifolia, and Phragmites communis were also performed. (See also W80-01209) (Steiner-Mass).
W80-01227

COMMUNITIES OF EMERGED FISHPOND SHORES AND BOTTOMS,
Ceskoslovenska Akademie Ved, Prague. Inst. of Entomology.
M. Rejmanek, and J. Velasquez.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 206-211, 1978. 2 Fig, 1 Tab.

Descriptors: *Ponds, *Biological communities, *Littoral, Wetlands, Marsh plants, Freshwater marshes, Plant growth, Growth stages, Emerging vegetation stage, *Czechoslovakia.

Communities of emerged fishpond shores and of summer-drained fishpond bottoms consist mostly of species populations or rapidly growing annual, biennial, or perennial plants with rather shallow root systems. The analysis of the growth and seasonal dynamics is thus relatively easy in these communities and their components. The depth of the nutrient-rich mud deposited on the bottom and soil moisture content represent the principal factors determining the growth and development of these populations. Two examples of growth analysis are given, one providing a comparison of growth dynamics in two communities colonizing different microhabitats in a summer-drained pond and the other showing the reaction of one monodominant community to the actual ecophase. (See also W80-01209) (Steiner-Mass)
W80-01228

PRIMARY DATA ON BIOMASS AND PRODUCTION ESTIMATES IN TYPICAL STANDS OF FISHPOND LITTORAL PLANT COMMUNITIES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. Kvet, and S. Husak.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 211-216, 1978. 1 Fig, 2 Tab.

Descriptors: *Marsh plants, *Littoral, *Biomass, Wetlands, Ponds, Freshwater marshes, Density, Distribution patterns, Shores, Aquatic plants, Rooted aquatic plants.

The table presented, as well as other published data, confirms that in fishponds, as in other standing waters, the plant biomass increases, in general, from the hydrophyte and pleustophyte communities of the sublittoral, through the communities formed by rooted macrophytes of the hydrooctophyte and ochthohydrophyte life forms of helophytes which constitute the prevailing littoral to limosal zones of the reed-belt. Further landward, the plant biomass again decreases with increasing distance from the shoreline and/or the groundwater table. A pronounced gradient of biomass is also observed in the dominant helophyte synusium in any sufficiently broad reed belt. The biomass of the undergrowth synasium then depends, in the first place, on the canopy density of the dominant. (See also W80-01209) (Steiner-Mass)
W80-01229

DETERMINATION OF ENERGY CONTENT AND NET EFFICIENCY OF SOLAR ENERGY CONVERSION BY FISHPOND HELOPHYTES,
Ceskoslovenska Akademie Ved, Trebon. Dept. Hydrobotany.
D. Dykyjova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 216-220, 1978. 1 Fig, 2 Tab.

Descriptors: *Marsh plants, *Energy conversion, *Efficiencies, Wetlands, Ponds, Littoral, Energy, Photosynthesis, Energy budget, Light, Plant growth.

The energy content is highest in young shoots in spring and decreases during the growing season. Fruits, flowers, and inflorescences have a higher energy content than either the vegetative aboveground parts or underground storage organs. The latter contain mainly glycids. The decrease in energy content with the aging of vegetative plant organs corresponds to other authors' data. It also reflects the seasonal decrease in the contents of energy-rich substances such as proteins, phosphatids, and other lipids, and the increase in the contents of energy-poor cell-wall materials such as cellulose, pectins, or lignin. The net conversion efficiency of solar energy calculated for a whole growing season is positively correlated with the seasonal maximum of biomass and negatively with the number of days of the growing season involved in the calculation. The shorter the growing season and the smaller the sum of incident radiation, the higher the coefficient of energy conversion. Several estimates of the coefficient for shorter time intervals during the growing season are thus of greater value. (See also W80-01209) (Steiner-Mass)
W80-01230

ESTIMATION OF NET PHOTOSYNTHETIC EFFICIENCY FROM GROWTH ANALYTICAL DATA,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. P. Ondok.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 221-227, 1978. 5 Fig, 2 Tab.

Descriptors: *Marsh plants, *Energy conversion, Wetlands, Cattails, Photosynthesis, Primary productivity, Plant growth, Efficiencies, Energy, Littoral.

Data on the seasonal increments in underground organs were obtained for Typha angustifolia and Typha latifolia and used for calculating the seasonal changes in the net assimilation rate (NAR). The NAR is quite high, with somewhat higher values in Typha angustifolia than in Typha latifolia. The high net photosynthetic efficiency of these species contributes to the explanation of the high productivity. As the net assimilation leaf efficiency (NALE) could not be evaluated, it could not be decided whether this high productivity is to be attributed to a highly favorable radiation regime in the Typha polycormones or to a high photosynthetic rate of their leaf tissues. NALE was calculated for a Phragmites stand and was determined not to exceed the value of 3.0 g/MJ. (See also W80-01209) (Steiner-Mass).
W80-01231

NET PHOTOSYNTHESIS AND DARK RESPIRATION OF REED ESTIMATED BY GAS-EXCHANGE MEASUREMENTS,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
J. Gloser.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 227-234, 1978. 7 Fig, 2 Tab.

Descriptors: *Marsh plants, *Respiration, *Photosynthesis, Wetlands, Freshwater marshes, Primary productivity, Plant physiology, Carbon cycle, Carbon dioxide, Leaves.

Gasometric measurements of net photosynthesis and dark respiration were performed with the aim of assessing some basic data necessary for mathematical modeling of canopy photosynthesis and primary production in Phragmites communis stands. The net photosynthetic and dark respiration rates were calculated from the values of CO2 uptake and output. The CO2 exchange characteristics were related to both leaf area and leaf weight as well as to individual leaf laminae. Photosynthetic activity was very little affected by leaf aging. The dark respiration rate per unit leaf area decreases from the youngest to the basal leaves, but in very old leaves, exceptionally high rates were detected in some instances. The inflorescences are characterized by low rates of net photosynthesis and by high rates of dark respiration. The CO2 concentration was never markedly less within the leaf canopy than was the above-canopy concentration. The CO2 depletion in the Phragmites stand caused by its photosynthetic activity is probably very small and unimportant in limiting the canopy photosynthesis. (See also W80-01209) (Steiner-Mass)
W80-01232

MODELING OF PHOTOSYNTHETIC PRODUCTION IN LITTORAL HELOPHYTE STANDS,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. P. Ondok, and J. Gloser.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 234-245, 1978. 10 Fig, 2 Tab.

Descriptors: *Marsh plants, *Model studies, *Photosynthesis, *Carbon dioxide, Wetlands, Freshwater marshes, Primary productivity, Respiration, Plant physiology, Carbon cycles, Littoral.

A model of CO2 uptake and dark respiration was derived for a pure stand of Phragmites communis. The model has empirical character in some points and mimics the principal functions of a photosynthetic system and their dependence on various factors. Stress is laid upon a detailed elaboration of the radiation interception regime which determines the input into the system. Several simplifications have been made in the first version of the model with respect to the importance of individual factors influencing photosynthesis. The model can be used to estimate the seasonal course of CO2 assimilation in the leaves and dark respiration in both leaves and stems and their seasonal totals. Another application of the model is the study of stand photosynthetic activity under various conditions simulated by enhancing parameters of the model. (See also W80-01209) (Steiner-Mass)
W80-01233

WATER RELATIONS, WATER BALANCE, TRANSPORATION, AND WATER TURNOVER IN SELECTED REEDSWAMP COMMUNITIES,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
M. Rychnovska.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 246-256, 1978. 3 Fig, 6 Tab.

Descriptors: *Marsh plants, *Transpiration, *Water balance, Wetlands, Freshwater marshes, Water loss, Littoral, Water storage, Plant physiology, Turnovers.

Mature shoots of Phragmites communis show considerable fluctuations in their water content expressed in terms of percentage dry weight. The variation in water content in whole shoots from populations in different biotopes is considerable. Plants from a stand at littoral ecophase and hence well-supplied with water mostly show a slightly lower water content than terrestrial stands. A considerable water saturation deficit can be determined in all Phragmites populations, regardless of whether they grow in water or on dry land. The transpiration rates (water loss per minute) are lower in all terrestrial stands than those found in littoral shoots. Because of rapid evaporation of the

morning dew, the period of transpiration during the day is, however, longer in the terrestrial Phragmites patch. The daily water output is thus much the same for both populations. (See also W80-01209) (Steiner-Mass)
W80-01234

NUTRIENT UPTAKE BY LITTORAL COMMUNITIES OF HELOPHYTES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
D. Dykyjova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 257-277, 1978. 13 Fig, 7 Tab.

Descriptors: *Marsh plants, *Nutrient requirements, *Productivity, Wetlands, Freshwater marshes, Littoral, Ponds, Nutrients, Plant physiology, Fertilizers, Nutrient removal, Calcium, Phosphorus.

In order to examine the relations between the nutrient availability and net production in helophyte communities in fishpond littorals, chemical analyses were made in their water, supropels, bottom soils, and plant biomass. To compare the chemistry in different habitats, only monocenotic communities were analyzed. The young and photosynthetically highly active leaves or shoots contain higher percentages of mineral nutrients than the stems. Some nutrients, such as P and Mg, become accumulated in panicles or fruits. Underground storage organs accumulate energy-rich organic matter, but relatively less of mineral elements. Calcium, entering the plants mainly passively with the transpiration stream, accumulates in the leaves in the form of insoluble compounds, and its content progressively increases with the aging of the leaf tissues. The helophyte species vary in their selective absorption capacity. Some species such as Sparganium erectum, Acorus calamus, and Glyceria maxima are highly plastic in their nutrient uptake and absorb high amounts of nutrients from the fertile sapropels. (See also W80-01209) (Steiner-Mass)
W80-01235

GROWTH, PRODUCTION AND NUTRIENT UPTAKE OF DUCKWEEDS IN FISHPONDS AND IN EXPERIMENTAL CULTURES,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
E. Rejmankova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 278-284, 1978. 6 Fig, 3 Tab.

Descriptors: *Plant growth, *Floating plants, *Marsh plants, Wetlands, Littoral, Ponds, Aquatic plants, Pondweeds, Productivity, Biomass.

The production of duckweeds was assessed in the littoral of the large Nesyt and Opatovicky fishponds, Czechoslovakia, in four small heavily eutrophicated village ponds in South Bohemia, and in outdoor hydroponic cultures. In the fishponds, the duckweed biomass was smallest in dense stands of both Phragmites communis and Typha angustifolia; duckweeds covered about a quarter of the water surface in these stands. The growth of duckweeds is limited there by very low irradiance at water levels. The differences in the relative growth rate of duckweeds in different helophyte stands are in agreement with the data on biomass. The growth of duckweed populations is negatively density-dependent after they have attained a 100% cover. In the hydroponic cultures it was found that the relative growth rate roughly follows the course of both the water temperature and the incoming solar radiation. (See also W80-01209) (Steiner-Mass)
W80-01236

STRUCTURAL ELEMENTS. PRINCIPAL POPULATIONS OF ALGAE. SPATIAL DISTRIBUTION.
Ceskoslovenska Akademie Ved, Brno. Dept. of Hydrobotany.
P. Marvan, J. Komarek, H. Ettl, and J. Komarkova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 295-313, 1978. 4 Fig, 7 Tab.

Descriptors: *Ponds, *Aquatic populations, *Aquatic algae, Littoral, Spatial distribution, Plant populations, Aquatic plants, Aquatic microorganisms, Census, Scum, Cyanophyta, Plankton, Diatoms.

A comparison was made of the algal flora in two fishponds, Opatovicky in South Bohemia and Neyst in South Morovia (Czechoslovakia). Both ponds were similarly managed and highly eutrophic. In Opatovicky, the most important elements are planktonic algae present in both the pelagial and the reed-belt for most of the year, with dominant chlorococcal and/or blue-green algae. In Neyst, the number of planktonic algal species is much the same, but many species occur solely in the eutrophicated western bay enriched with phytoplankton from the principal inflow. This is rich in chlorococcal algae, centric diatoms, and in flagellates belonging to different taxonomic groups. Filamentous green algae, however, take up a prominent position in Neyst, being the most productive component of the littoral algal vegetation. Their communities comprise relatively few dominants capable of rapid growth and reproduction under favorable conditions. (See also W80-01209) (Steiner-Mass)
W80-01237

DYNAMICS OF ALGAL COMMUNITIES,
Ceskoslovenska Akademie Ved, Brno. Dept. of Hydrobotany.
P. Marvan, J. Komarek, H. Ettl, and J. Komarkova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 314-320, 1978. 2 Fig.

Descriptors: *Aquatic algae, *Plankton, *Dynamics, Wetlands, Ponds, Marsh plants, Aquatic populations, Aquatic microorganisms, Plant populations, Marsh management, Littoral.

Plankton elements take up an important position in many types of littoral macrophyte communities in most fishponds. The dynamics of their development appear to be influenced not only by changes in the physical, chemical, and biotic factors in the littoral community, but also by those in the pelagial and by the intensity of water exchange between the two zones. The course of changes in the composition of phytoplankton may be altered by fishpond management. (See also W80- 01209) (Steiner-Mass)
W80-01238

PRIMARY PRODUCTION AND FUNCTIONING OF ALGAE IN THE FISHPOND LITTORAL,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. Komarkova, and P. Marvan.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 321-334, 1978. 5 Fig, 8 Tab.

Descriptors: *Aquatic life, *Littoral, *Primary productivity, Wetlands, Ponds, Plankton, Aquatic plants, Phytoplankton, Periphyton, Fish management.

In all instances, the helophyte production in the littoral surpasses considerably that of the phytoplankton. As the phytoplankton represents the most important source supporting the trophic steps leading to fish production, and the phytoplankton development is controlled by the density of the helophyte communities, an excessively wide shallow littoral zone is regarded as undesirable in intensely managed fishponds. If the total primary production by algae in a whole managed fishpond is considered from this aspect, the participation of the littoral in aquatic primary production is relatively small in comparison with the production in the open water. These data contradict those from several lakes inferring that the littoral zone is more productive and its phytoplankton and periphyton play an important part in the primary production of the whole lake. (See also W80-01209) (Steiner-Mass)
W80-01239

DECOMPOSITION PROCESSES IN THE FISHPOND LITTORAL,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
B. Ulehlova.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 341-353, 1978. 5 Fig, 6 Tab, 27 Ref.

Descriptors: *Littoral, *Marsh plants, *Decomposing organic matter, Wetlands, Detritus, Ponds, Nitrogen, Carbon, Deterioration, Rates, Temperature.

Definite temporal and spatial patterns characterize the decomposition rate of organic materials. The decomposition rate depends on the quality of the plant material and on the time of exposure. The rate decreases with advanced decomposition. The temperature, moisture content, and aeration are the determinants in the decomposition process. The half-time of decomposition of plant remnants varies from 4 to 12 months, according to the kind of plant material. During the decomposition of plant remnants, their carbon content decreases concurrently with the loss in weight. In winter, the loss of carbon and phosphorus from the decomposing plant material proceeds at a higher rate than in summer, reflecting changes in predominance of either mineralization or humification. Nitrogen content usually increases in the decomposing plant material. The increase in nitrogen content is greater than that expected from carbon loss, pointing to an active accumulation of nitrogen. (See also W80-01209) (Steiner-Mass)
W80-01240

MAMMALS IN THE REEDSWAMP ECOSYSTEM,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
J. Pelikan.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 366-372, 1978. 2 Fig, 1 Tab.

Descriptors: *Wetlands, *Mammals, *Productivity, Aquatic animals, Wildlife habitats , Rodents, Wildlife, Distribution, Freshwater marshes, *Czechoslovakia.

Investigations of the secondary productivity and the function of mammals in wetlands of Czechoslovakia were carried out to discover the species diversity, the ecological dominance of species in successive trophic levels, and the energy flow and role of the mammalian populations in the wetland ecosystems. The research was carried out in the South Moravian lowlands. Particular attention was paid to the water role (Arvicola terrestris) with respect to its negative effects on gardens and orchards. (See also W80-01209) (Steiner-Mass)
W80-01241

BIRDS IN THE REEDSWAMP ECOSYSTEM,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
K. Hudec, and K. Stastny.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 366-372, 1978. 2 Fig, 1 Tab.

Descriptors: *Freshwater marshes, *Birds, Wetlands, Distribution patterns, Water birds, Wildlife, Wildlife habitats, Broods, Nests, Census, Animal populations, Productivity, *Czechoslovakia.

Investigations were made on the secondary production and role of birds in the reedswamp ecosystems in Czechoslovakia. Data was obtained on the species composition and numbers of birds breeding in various types of reedswamps, on the basic parameters of population dynamics, and on the impact of the dominant bird species on the reedswamp vegetation. The investigations were carried out in the regions, in South Moravia and South Bohemia. (See also W80-01209) (Steiner-Mass)
W80-01242

SOIL SURFACE ARTHROPODS,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
R. Obrtel.

In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 373-375, 1978.

Descriptors: *Freshwater marshes, *Insects, Wetlands, Aquatic animals, Diptera, Mites, Census.

Material of surface-active arthropods was obtained in the terrestrial ecophase of a Czechoslovak reeds-wamp. The material consisted of isopods, spiders, mites, harvestmen, and insects, both at their adult and developmental stages. Of the insects the material comprised springtails, beetles, various forms of dipterous insects, aphids, leafhoppers, and various forms of hymenopterous insects. (See also W80-01209)
W80-01243

INVERTEBRATES: DESTROYERS OF COMMON REED,
Ceskoslovenska Akademie Ved, Prague. Inst. of Entomology.
V. Skuhravy.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 376-388, 1978. 9 Fig, 1 Tab.

Descriptors: *Marsh plants, *Invertebrates, *Plant growth, Wetlands, Freshwater marshes, Insects, Insect behavior, Damages, *Czechoslovakia.

Attention was focused on specie s causing damage to common reed and depleting its reproductive rate. According to the type of injury, the following breakdown was made: (1) Species damaging the growing point of the reed (with or without gall formation) and checking the growth of reed stems, (2) species developing inside the stems and causing them to break, (3) species causing lateral damage by attacking lateral shoots, and (4) species living on the leaves. (See also W80-01209) (Steiner-Mass)
W80-01244

MACROFAUNA OF INVERTEBRATES IN HELOPHYTE COMMUNITIES,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
J. Dvorak.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 389-392, 1978. 1 Tab.

Descriptors: *Freshwater marshes, *Invertebrates, *Aquatic animals, Wetlands, Distribution patterns, Littoral, Marsh plants, Biomass, *Czechoslovakia.

Both the quality and quantity of the macrofauna are subject to marked seasonal changes in each habitat followed. This seasonal succession reflects the pattern of life cycles and migration of the populations constituting the respective animal communities. Gradients from the shoreline to open water pertain not only to the environmental factors but also to the quantitative structure and dynamics of the animal communities. Such gradients develop even within one helophyte community type, particularly in Glycerietum maximae. The animal communities seem to constitute themselves in relation to a whole complex of ecological factors, without specific bonds to any particular plant community type. More pronounced effects of the vegetation cover have only been observed in communities dominated by Carex spp., Equisetum limosum, and Phragmites, while Glceria maxima and Sparganium erectum have little effect on the animal communities. (See also W80-01209) (Steiner-Mass)
W80-01245

CONTROL OF REED AND REED MACE STANDS BY CUTTING,
Ceskoslovenska Akademie Ved. Prague. Botanicky Ustav.
S. Husak.
In Pond: Littoral Ecosystems, Springer-Verlag, New York, p 404-408, 1978. 2 Fig, 1 Tab.

Descriptors: *Marsh plants, *Cutting management, *Cattails, Wetlands, Freshwater marshes, Marsh management, Vegetation regrowth, Plant growth.

Investigations were aimed at assessing the response of Typha angustifolia and Phragmites communis to the prevention of flowering and to varying degrees of control by cutting. The species reacted to the destructive control very differently. Typha was quicker both to react and to regenerate after cutting. In Phragmites, the cut induced an increase in stand de nsity and homogeneity. The cut was applied to the Phragmites stand somewhat late to induce any drastic changes in its performance. A more pronounced response would have been induced if the treatment had been supplied earlier; best in early June, at the time of lowest reserve content in the rhizomes but immediately before the onset of panicle emergence at the latest. (See also W80-01209) (Steiner-Mass)
W80-01247

PROPAGATION, CULTIVATION AND EXPLOITATION OF COMMON REED IN CZECHOSLOVAKIA,
Ceskoslovenska Akademie Ved, Trebon. Inst. of Microbiology.
K. Veber.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 416-423, 1978. 4 Fig, 3 Tab.

Descriptors: *Marsh plants, *Marsh management, *Cultivation, Wetlands, Freshwater marshes, Vegetation establishment, Planting management, Cutting management, Value, Crop production, Productivity, *Czechoslovakia.

In Czechoslovakia, the demand for reed products exceeds their production because the supply of high-quality reed culms is insufficient. Efforts are being made to increase reed production by effectively exploiting the existing reed sources as well as by establishing new reed beds. A survey is given of methods of reed propagation, cultivation, and introduction required to achieve this aim. The present state of commercial reed production in Czechoslovakia is also reviewed. (See also W80-01209) (Steiner-Mass)
W80-01249

CONSERVATION OF PLANT COMMUNITIES IN FISHPOND LITTORALS,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
For primary bibliographic entry see Field 2H.
W80-01250

CONSERVATION OF WILDFOWL IN FISHPOND REGIONS,
Ceskoslovenska Akademie Ved, Brno. Inst. of Vertebrate Zoology.
K. Hudec, and K. Stastny.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 434-437, 1978.

Descriptors: *Wildlife, *Conservation, *Freshwater marshes, Wetlands, Ponds, Littoral, Marshes, Marsh management, Wildlife habitats, Birds, *Czechoslovakia.

Conserving large areas covered with reed is of importance for the occurrence of certain species of birds; namely, the large and typically reed-inhabiting ones. For a numerous occurence of the major species, rather narrow reed-belts of sufficient lengths are satisfactory. A very narrow belt of pure reed, less than about 10 m in width, is satisfactory for just a small number of species. The areas adjacent to the reed stands on the shore are very important for some of the reed-inhabiting species of birds. It is particularly advantageous if the reed stands pass gradually into permanent low waterlogged vegetation, at least on a minor part of the whole area. Presence of water in stands is essential. (See also W80-01209) (Steiner-Mass)
W80-01251

DETERMINISTIC HYDROLOGIC MODELING OF GRAZING SYSTEM IMPACTS ON INFILTRATION RATES,
Utah State Univ., Logan. Watershed Science Unit.
For primary bibliographic entry see Field 2G.
W80-01544

BIBLIOGRAPHY OF ENVIRONMENTAL STUDIES ON LAKE CHAMPLAIN,
For primary bibliographic entry see Field 2H.
W80-01581

2J. Erosion and Sedimentation

MODIFICATIONS TO THE MACKERETH CORER,
Australian National Univ., Canberra (Australia). Research School of Earth Sciences.
C. E. Barton, and F. R. Burden.
Limnology and Oceanography, Vol 24, No 5, p 977-983, September 1979. 3 Fig, 1 Tab, 2 Ref.

Descriptors: *Core drilling, *Equipment, *Lake sediments, Cores, Sediments, Lakes, Instrumentation, Design, Sampling, Paleoclimatology, Paleolimnology, Limnology, Sedimentology, Sediment corers, Paleomagnet.

The 6-m Mackereth corer has proved excellent for many aspects of Quaternary research, particularly in the growing field of paleomagnetic work on lake sediments. A 12-m version of the corer was described together with a magnetic orientation system. (Sims-ISWS)
W80-01268

RESUME OF RESEARCH INTO RIVER CHANNEL CHANGES CONDUCTED IN THE USSR,
Gosudarstvennyi Gidrologicheskii Inst., Leningrad (USSR).
V. V. Kuprianov, and Z. D. Kopaliani.
Hydrological Sciences Bulletin, Vol 24, No 3, p 345-349, September 1979. 1 Fig, 11 Ref.

Descriptors: *Channel morphology, *Rivers, *Erosion, *Sedimentation, Sediments, Sediment transport, Deposition(Sediments), Meanders, Islands, Channels, Streamflow, Soil mechanics, Geomorphology, Hydrodynamics, Hydrology, *USSR.

This paper described briefly some findings and investigations on the problem of channel processes conducted in the USSR. The development of the general theory of channel processes is far from complete. The present stage in the development of the hydromorphological trend shows the tendency for deeper quantitative analyses of the channel processes and for the improvement of quantitative methods for the computation and forecasting of the channel changes. Taking into account the complicated nature of the given problem and its importance all over the world, it seems expedient to exchange ideas, information, research experience, and results obtained by scientists representing various schools of different countries. (Sims-ISWS)
W80-01274

RADIOCARBON DATING OF A CORE FROM LONG ISLAND SOUND,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
G. J. Benoit, K. K. Turekian, and L. K. Benninger.
Estuarine and Coastal Marine Science, Vol 9, No 2, p 171-180, August 1979. 1 Fig, 2 Tab, 26 Ref. DOE EY-76 S-02-3573.

Descriptors: *Radioactive dating, *Carbon radioisotopes, *Sedimentation rates, Sediments, Cores, Sampling, Carbon, Organic matter, Analytical techniques, Chemical analysis, Measurement, Mathematical models, Coasts, Estuaries, *Long Island Sound, *Connecticut coast.

Radiocarbon measurements sequentially with depth in a diver-obtained core from Long Island Sound were interpreted in terms of sediment accumulation rates and sources of organic carbon in the sediment. A sediment accumulation rate of 0.075 plus or minus 0.013 cm/year was determined from the data below 10 cm in the core. An age of 2320 year BP was obtained for the sediment-water interface by extrapolation. This means that the dominant carbon component preserved in the core was soil-derived. The contributions of fossil fuel carbon and bomb radiocarbon associated with plankton were also evaluated. (Sims-ISWS)
W80-01289

NOTES ON SEDIMENTATION ACTIVITIES CALENDAR YEAR 1976,
Water Resources Council, Washington, Sedimentation Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 542, Price codes: A11 in paper copy, A01 in microfiche. September 1977. 242 p, 16 Ref, 1 Append.

Descriptors: *Sedimentation, *Research and development, *Projects, Research facilities, Federal government, Sediment transport, Suspended solids, Erosion, Sedimentation rates, Sediments, Sedimentology, Reviews.

This report was a digest of information furnished by Federal agencies conducting sedimentation investigations on work in progress or planned, important fundings, new methods, new publications, laboratory and other research activities, and other pertinent information. The material was organized by major drainage regions in the conterminous United States, Alaska, Hawaii, Puerto Rico, and foreign. There was also a section on research and other activities. Appendix A listed agency addresses by departments where information on agency activities can be obtained. (See also W78-01185 and W78-05057) (Froehlich-ISWS)
W80-01294

VARIATION OF ALLUVIAL-CHANNEL WIDTH WITH DISCHARGE AND CHARACTER OF SEDIMENT,
Geological Survey, Lawrence, KS. Water Resources Div.
W. R. Osterkamp.
Geological Survey Water-Resources Investigations 79-15, June 1979. 11 p, 4 Fig, 9 Ref.

Descriptors: *Alluvial channels, *Flow characteristics, *Channel morphology, *Effects, *Sedimentation, Bottom sediments, Bank stability, Width, Perennial streams, Data collections, Analytical techniques, Evaluation, *Channel width-discharge relationship, Fixed exponent.

Use of channel measurements to estimate discharge characteristics of ungaged streams has shown that little agreement exists for the slope of the width-discharge regression relation. Three groups of perennial stream channels with differing characteristics were selected for study using consistent procedures of width measurement. A common feature of the groups was general channel stability, that is, absence of excessive widening by recent extremely high discharges. The groups were: (1) 32 channels of gradient exceeding 0.0080, low suspended-sediment discharge, high channel roughness, and low discharge variability; (2) 13 streams of similar climatic conditions and having at least 70 percent silt and clay in the bed material; and (3) 18 spring-discharge channels with steady discharge and similar climate. Values for the exponent for the three groups are 1.98, 1.97, and 1.97, respectively; coefficient values are 0.017, 0.042, and 0.011 (when using metric units). Assuming a constant exponent of 2.0, equations were developed expressing the manner in which channel sediment affects the width-discharge relation. (Woodard-USGS)
W80-01426

NOTES ON SEDIMENTATION ACTIVITIES, CALENDAR YEAR 1977,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-01593

2K. Chemical Processes

IMPACT OF WATER AND SOILS HAVING HIGH SOURCE-SINK POTENTIALS ON WATER AND SALINITY MANAGEMENT UNDER IRRIGATION IN THE UPPER COLORADO RIVER BASIN.
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
L. S. Williardson, R. Hanks, and J. Jurinak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-111727 Price Codes: A06 in paper copy, A01 in microfiche. Utah Water Research Laboratory, Utah State University, Water Resources Planning Series P-79/06, July 1979, 101 p, 74 Fig, 10 Tab, 6 Append, OWRT-B-148-UTAH (1), 14-34-0001-7195.

Descriptors: *Saline soils, *Irrigation water, *Cation exchange, *Sinks, Water chemistry, Salinity, Leaching, Return flow, Water quality, Irrigation, *Ashley Valley(UT), *Water management model.

A soil solution chemistry model was developed to describe the soil-irrigation water interactions. The model includes the effect of cation exchange capacity. The model was calibrated and checked with data obtained from lysimeters. A water management model that contained a soil solution chemistry component was calibrated for the Ashley Valley of Utah and was used to determine the sensitivity of stream flows and salinity to irrigation water management alternatives. The source-sink behavior of soils was found to depend on water quality, residual soil salinity, and water management practices. The key relationships are described. In applying these relationships, site specific conditions must be examined to determine the effectiveness of proposed irrigation management changes that are expected to affect downstreams salinity.
W80-01208

WATER CHEMISTRY IN THE FISHPOND LITTORALS,
Ceskoslovenska Akademie Ved, Brno. Dept. of Ecology.
B. Ulehlova, and S. Pribil.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 126-140, 1978. 14 Fig, 4 Tab.

Descriptors: *Water chemistry, Temporal distribution, *Littoral, Wetlands, Farm ponds, Phosphorus, Nitrates, Mineralogy, Ammonia.

Certain cations and anions show typical patterns of seasoral variations despite differences in pond management. Nitrates and ammonia are relatively high in early spring and low during the rest of the year. Potassium, bicarbonate, and phosphate tend to increase more or less steadily from spring to fall. Two main peaks of phosphorus appeared on the curves for water samples from different sites, one in late May to early June, and the other in late July to early August. In these periods, phosphate phosphorus was intensely released either from dying-off biotic populations or from decaying organic materials. (See also W80-01209) (Steiner-Mass)
W80-01220

CHARACTERIZATION OF THE PH BUFFERING SYSTEMS IN DILUTE ADIRONDACK SURFACE WATERS,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
J. J. Bisogni, Jr., and C. T. Driscoll, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-113426, Price codes: A07 in paper copy, A01 in microfiche. Technical Completion Report, October, 1979. 134 p, 44 Fig, 23 Tab, 45 Ref, 15 Append. OWRT A-073-NY (1), 4-34-0001-7068 and 8034.

Descriptors: *Water chemistry, *Hydrogen ion concentrations, *Lakes, *Streams, Aluminum, Hydrogen, Acid precipitation, Buffer capacity, Adirondak Region (NY).

This research project investigated the aquatic chemistry of some dilute surface waters in the Adirondack Region of New York State. Particular emphasis was placed on characterizing the pH buffering systems in lakes and streams that have experienced acid precipitation. Eighteen water quality parameters were monitored for a period of one year at three lakes and their tributaries . Lake sediment analyses were also performed. Analytical methods were developed to estimate speciation of aluminum and to estimate the components of acid neutralizing capacity. The results of this study indicate that acid cations, hydrogen and aluminum, play a significant role in the overall aqueous chemistry of the surface waters studied. Natural organic acids and inorganic aluminum are very important pH buffering components in these waters.
W80-01257

IMPACT OF WESTERN COAL MINING--I. CHEMICAL INVESTIGATIONS OF A SURFACE COAL MINE SEDIMENTATION POND,
Montana State Univ., Bozeman. Dept. of Microbiology.
S. C. Turbak, G. J. Olson, and G. A. McFeters.
Water Research, Vol 13, No 11, p 1023-1031, 1979. 3 Fig, 1 Tab, 35 Ref.

Descriptors: *Coal mines, *Strip mines, *Mine water, *Montana, Water chemistry, Chemicals, Sodium, Sulfates, Bicarbonat es, Nitrogen, Dissolved oxygen, Ions, Cautions, Anions, Mercury, Hydrogen ion concentration, Sampling, Chemical analysis, Ponds.

Chemical investigations of the sedimentation pond system at the West Decker Mine in southeastern Montana were undertaken during an 18 month period from November 1975 to April 1977. Sedimentation pond water, essentially 'altered' groundwater, differed chemically from the average groundwater in coal-bearing aquifers. The increase in certain chemical constituents (sodium, sulfate, bicarbonate and inorganic nitrogen) and the decrease in dissolved oxygen in pond water during autumn 1976 and winter 1977 were the results of erratic pond operation, dreging, and increased nearby mining activity. Discharge from the pond complied with the guidelines advanced for effluents from surface coal mines. Levels of mercury in water samples collected from the sedimentation pond system were higher than those recommended for the protection of aquatic life and wildlife. The suitability of pond water for selected purposes and recommendations for improvement in pond design were discussed. (Sims-ISWS)
W80-01285

CHLORINE, BROMINE AND IODINE IN MONSOON RAINS IN INDIA,
Bhabha Atomic Research Centre, Bombay (India). Air Monitoring Section.
S. Sadasivan, and S. J. S. Anand.
Tellus, Vol 31, No 3, p 290-294, August 1979. 3 Tab, 3 Ref.

Descriptors: *Chemistry of precipitation, *Monsoons, *Rain, *Halogens, Sampling, Chemical analysis, Rainfall, Sea water, Chlorine, Bromine, Iodine, Sodium, Rain water, Analytical techniques, Precipitation(Atmospheric), *India.

The mean concentrations of the halogens chlorine, bromine, and iodine in a large number of rainwater samples collected in India during the south-west monsoon at the west coast and at two sites on the hill range near the west coast were presented and discussed. The concentration and ratios of these halogens in the rainwater samples compared very well with those previously observed in marine precipitations. There was no change in the Cl/Na ratios with collection altitude. Br showed a slight enrichment relative to Na at most of the sampling locations and a nominal depletion at one of the sites on the hills. Iodine enrichment was high at all sampling sites, and the samples from the higher altitude station on the hills showed the maximum enrichment. The study confirmed that large deposition of sea salt occurs along the west coast of India due to the monsoonal flow. (Sims-ISWS)
W80-01291

CHEMICAL QUALITY OF GROUND WATER IN THE EASTERN SACRAMENTO VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. P. Fogelman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301 241, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations

78-124, June 1979. 45 p, 10 Fig, 10 Tab, 28 Ref.

Descriptors: *Water quality, *Groundwater, *Chemical analysis, *Water wells, *Water types, Biocarbonates, Water utilization, Crop response, Irrigation, Agriculture, Domestic water, Water analysis, Drawdown, Pumping, Evaluation, Water chemistry, California, *Eastern Sacramento Valley(CA).

The study area is about 1,300 square miles in the eastern Sacramento Valley, Calif., extending from the latitude of Roseville on the south to thelatitude of Chico on the north. Considering the increased agricultural development of the area, this report documents the chemical character of the ground water prior to water-level declines that could result from extensive pumping for irrigation or to changes caused by extensive use of imported surface water. Chemical analyses of samples from 222 wells show that most of the area is underlain by ground water of a quality suitable for most agricultural and domestic purposes. Ninety-five percent of the water sampled has dissolved-solids concentrations of less than 700 milligrams per liter. The general water type for the area is a calcium and magnesium bicarbonate water and there are negligible amounts of toxic trace elements. The potential for water-quality problems exists in the area south of Yuba City along the west bank of the Feather River. There, concentrations of chloride, sulfate, and dissolved solids are higher than in other parts of the area, and they could limit future agricultural activities if chloride- and sulfate-sensitive crops are grown. (Woodard-USGS)
W80-01425

2L. Estuaries

ALKALINITY AND PH IN THE SOUTHERN CHESAPEAKE BAY AND THE JAMES RIVER ESTUARY,
Old Dominion Univ., Norfolk, VA. Inst. of Oceanography.
G. T. F. Wong.
Limnology and Oceanography, Vol 24, No 5, p 970-977, September 1979. 6 Fig, 2 Tab, 18 Ref.

Descriptors: *Alkalinity, *Hydrogen ion concentration, *Chesapeake Bay, *Estuaries, On-site investigation, On-site data collections, Sampling, Surveys, Data processing, Regression analysis, Chemicals, Water chemistry, Salinity, Coasts, Water circulation, *James River(VA), Carbonic acid.

The ranges of alkalinity and pH in the southern Chesapeake Bay and the James River estuary were 2.25 meq/liter at 32 parts per thousand to less than 0.85 at salinities below 6 parts per thousand and 7.5-8.3 during the sampling period. Alkalinity was linearly related to salinity in southern Chesapeake Bay. In the James River estuary, the relationship is more complicated as a result of the mixing of various sources of water or the removal of alkalinity. pH values increase with salinity. The variations in pH may be caused by the salinity-dependence of the apparent dissociation constants of carbonic acid. (Sims-ISWS)
W80-01267

EXPLORING DATA STRUCTURE OF NEW YORK BIGHT BENTHIC DATA USING POST-COLLECTION STRATIFICATION OF SAMPLES, AND LINEAR DISCRIMINANT ANALYSIS FOR SPECIES COMPOSITION COMPARISONS,
Rhode Island Univ., Kingston. Dept. of Experimental Statistics.
H. A. Walker, S. B. Saila, and E. L. Anderson.
Estuarine and Coastal Marine Science, Vol 9, No 2, p 101-120, August 1979. 10 Fig, 6 Tab, 22 Ref.

Descriptors: *Statistical analysis, *Atlantic Ocean, *Benthic fauna, *Environment, *Biological communities, Benthos, Marine biology, Sampling, Sediments, Particle size, Organic matter, Heavy metals, Waste dumps, Biology, Oceans, Analytical techniques, *New York Bight, Benthic environment, Environmental changes.

Techniques for exploring data structure from four cruises on a rectilinear sampling grid system on the New York Bight were presented. The problem of microenvironmental variability was handled by post-collection stratification of samples based on the physical characteristics of each grab rather than on classical spatial strata definitions. The three physical variables used to define strata were: mean particle size, percent organic matter, and total concentration of selected heavy metals. Variations in species densities within strata over time were investigated. Multivariate discriminant techniques were used to search for major statistical differences in a species abundance between strata. A flexible sampling program based on post-collection stratification was suggested to detect shifts in mean species abundance within strata over time. (Sims-ISWS)
W80-01287

BEHAVIOUR OF MANGANESE IN THE RHINE AND SCHELDT ESTUARIES, I. PHYSICO-CHEMICAL ASPECTS,
Brussels Univ. (Belgium). Lab. of Oceanography.
R. Wollast, G. Billen, and J. C. Duinker.
Estuarine and Coastal Marine Science, Vol 9, No 2, p 161-169, August 1979. 7 Fig, 1 Tab, 10 Ref.

Descriptors: *Manganese, *Estuaries, *Equilibrium, *Physicochemical properties, *Model studies, Mathematical models, Rivers, Heavy metals, Thermodynamics, Hydrogen ion concentration, Salinity, Coasts, Tidal waters, Chemicals, Oxygen, Chemistry, *North Sea coast.

An equilibrium model of the behavior of manganese during mixing of river water and seawater in estuaries was established on the basis of published thermodynamic data about manganes species in natural waters. The chemical control parameters taken into consideration were: ionic strength, pH, oxygen concentration, and total dissolved carbonate content. This model was shown to account for at least the general trends of dissolved manganese variations observed in the Rhine and Scheldt estuaries. Some data about the kinetics of the processes involved in manganese transformations in these two environments suggested that the close approach of the thermodynamic equilibrium is a consequence of the high turbidity and the intense microbiological activity present in these heavily polluted estuaries. (Sims-ISWS)
W80-01288

RADIOCARBON DATING OF A CORE FROM LONG ISLAND SOUND,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2J.
W80-01289

TIDALLY INDUCED RESIDUAL CURRENTS IN ESTUARIES OF VARIABLE BREADTH AND DEPTH,
Connecticut Univ., Groton Marine Sciences Inst.
J. P. Ianniello.
Journal of Physical Oceanography, Vol 9, No 5, p 962-974, September 1979. 5 Fig, 1 Tab, 18 Ref, 1 Append.

Descriptors: *Estuaries, *Currents(Water), *Tides, *Model studies, Mathematical models, Tidal waters, Circulation, Water circulation, Tidal streams, Equations, Winds, Depth, Channels, Flow, *Residual currents.

Analytic solutions were derived for the longitudinal and cross-channel Eulerian and Lagrangian residual currents induced in narrow tidal channels of variable breadth and depth, but rectangular cross section, by the nonlinear interactions of the first-order tides. The solutions were shown to be valid as long as the system is weakly nonlinear such that g eta sub o/sq sigma/sq Delta x is much less than 1, and as long as breadth variations are sufficiently gradual that f beta sub o/sigma/Delta x is much less than 1; beta sub o is a typical tidal amplitude, g is the acceleration of gravity, sigma the tidal frequency, Delta x the length scale over which the breadth changes, f the Coriolis parameter, and beta sub o the channel width. Results were given for channels with exponentially decreasing breadth and depth profiles and for a channel with a constriction in the breadth profile. These results indicated that significant differences from the residual currents in constant breadth and depth channels occur for all three types, but especially for the constricted channel. For this channel, a strong two-layer structure with a divergence in the surface water and a convergence in the bottom water, centered at the constriction, was generated for both the Eulerian and Lagrangian currents. This two-layer flow reinforces any two-layer density-induced circulation seaward of the constriction and opposes it landward of the constriction. The existence of a two-layer flow has important implications for the estuarine circulation; furthermore, since such a two-layer flow will not appear in depth-averaged models of the residual currents induced in narrow tidal channels, it may confound attempts to verify such models from measurements. (Sims-ISWS)
W80-01293

A REAL TIME MODEL OF NITROGEN-CYCLE DYNAMICS IN AN ESTUARINE SYSTEM,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
For primary bibliographic entry see Field 5C.
W80-01355

DISTRIBUTION OF INTERTIDAL DIATOMS ASSOCIATED WITH SEDIMENTS IN YAQUINA ESTUARY, OREGON,
Oregon State Univ., Corvallis, Dept. of Botany and Plant Pathology.
For primary bibliographic entry see Field 5C.
W80-01436

ASSIMILATION OF PARTICULATE ORGANIC CARBON BY ESTUARINE AND COASTAL COPEPODS,
City Univ. of New York.
For primary bibliographic entry see Field 5C.
W80-01453

MOVING BOUNDARY NUMERICAL SURGE MODEL,
Oak Ridge National Lab. TN.
G-T Yeh, and F.-K Chou.
Journal of the Waterway, Port, Coastal and Ocean Division, Amerian Society of Civil Engineers, Vol 105, No WW3, Proceedings Paper 14758, p 247-263, August 1979. 10 Fig, 1 Tab, 20 Ref.

Descriptors: *Storm surges, *Simulation analysis, *Maine, *Numerical analysis, *Mathematical models, *Gulf of Mexico, Hydraulics, Hydrodynamics, Model studies, Equations, *Boundary values, Finite difference method, Moving boundary models.

This paper adopts the time-split explicit (TSE) finite difference technique to simulate the storm surge on the vertically integrated hydrodynamic equations of continuity and momentum. The unique feature of the present model lies in its treatment of water-land interfaces as moving boundaries (MB). The conventional assumption of fixed boundary (FB) with a vertical wall located at the water-land interface of mean sea level is completely discarded. In the present model, the advancing and retreating of the surge wave over the low-lying dry land and the propagation of the water-land interface were dealt with on the basis of physical and mathematical principles. Numerical experiments indicated that the MB model predicts lower surge level at the coast line as much as 30% than the FB model when the adjacent inland area has a mild slope and the wind is very strong. The MB model yielded better agreement with recorded surge than the FB model, which consistently overpredicts the surge elevations. (Lee-ISWS)
W80-01456

STUDIES OF PHSOPHORUS MOVEMENT USING SALT MARSH MICROECOSYSTEMS,

Auburn Univ., AL.
J. W. Everest, and D. E. Davis.
Journal of Environmental Quality, Vol 8, No 4, Oct - Dec 1979, p 465-468. 1 Fig, 3 Tab, 16 Ref.

Descriptors: *Microecosystems, *Salt marshes, Phosphorus, Movement, Radioactivity, Smooth cordgrass, Diatoms, Mud fiddler crabs, Ribbed mussels, Marsh soil, Sea water.

Microecosystems of a salt marsh community were designed, constructed, and used to follow phosphorus flux through the physical biological components of that community. The biological components in these microecosystems were smooth cordgrass (Spartina alterniflora Loisel), diatoms, mud fiddler crabs (Uca pugnax Smith), periwinkle snails (Littorina irrorate Say), and ribbed mussels (Geukensia demissa Dillwyn; formerly Modiolus demisus Dillwyn). The physical components were the marsh soil and the seawater. Phosphorus 32p was secreted by the leaves of smooth cordgrass during the experiment. The rapid transfer of phosphorus to the soil surface was found to be the result of the burrowing activity of the fiddler crabs.
W80-01538

HYDROLOGY OF MAJOR ESTUARIES AND SOUNDS OF NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
G. L. Giese, H. B. Wilder, and G. G. Parker, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-299876, Price codes: A09 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-46, July 1979. 175 p, 95 Fig, 1 Plate, 14 Tab, 78 Ref.

Descriptors: *North Carolina, *Estuaries, *Saline water intrusion, *Tidal effects, *Water quality, Saline water-freshwater interfaces, Water chemistry, Sedimentation, Water level fluctuations, Wind tides, Hurricanes, Flow charactetiristics, Reservoir releases, *Albemarle Sound, *Pamlico Sound, Cape Fear River, Neuse River, Trent River, Tar River, Pamlico River, Chowan River, Roanoke River.

Knowledge of the basic hydrology of North Carolina's major estuaries and sounds is necessary to help solve hydrology-related estuarine problems which include contamination of some estuaries with municipal and industrial wastes and drainage from adjacent intensively-farmed areas, nuisance-level algal blooms, excessive shoaling in some navigation channels, saltwater intrusion into usually fresh estuarine reaches, too-high or too-low salinities in nursery areas for various estuarine species, and flood damages due to hurricanes. Saltwater intrusion occurs from time to time in all major estuaries in North Carolina except the Roanoke River, where releases from Roanoke Rapids Lake and other reservoirs during otherwise low-flow periods effectively block saline water from the estuary. (Woodard-USGS)
W80-01598

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

RESEARCH AND DEVELOPMENT ON A SPIRAL-WOUND MEMBRANE SYSTEM FOR SINGLE-STAGE SEAWATER DESALINATION,
Universal Oil Products Co., San Diego, CA. Fluid Systems Div.
R. L. Riley, and C. E. Milstead.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-114705, Price codes: A13 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, October 31, 1979. 284 p, 48 Fig, 97 Tab, 22 Ref, 2 Append. OWRT S-0098 (No 7543) (1), 14-34-0001-7543.

Descriptors: *Membranes, *Reverse Osmosis, *Desalination, *Sea water, Desalination processes, Desalination apparatus, Research and development, *Jeddah(Saudi Arabia), *Wrightsville Beach(NC), Water Factory 21-Orange County(CA), Spiral-wound elements.

Single-stage desalination of seawater by reverse osmosis requires a membrane which approaches theoretical semipermeability and is sufficiently thin to provide transport of water at practical operating pressures and recovery rates. This objective has been achieved by the development of a family of four thin-film composite membranes (TFC) based on nitrogen-containing polymers supported on a fabric-reinforced prorous supporting membrane. Long-term field testing of spiral-wound TFC membrane elements was conducted at the OWRT Test Facility at Wrightsville Beach, NC to determine the stability of the elements as functions of feed temperature, water recovery, dissolved oxygen, cleaning techniques, etc. In laboratory tests, the relati. • stability of each membrane was determined to materials commonly encountered during membrane storage and operation, e.g., cleaning agents, formaldehyde, sodium bisulfite, and sodium thiosulfate. The world's largest reverse osmosis system for seawater desalination, based on the newly developed spiral-wound TFC membrane elements, was placed on-line in 1979 to supply 12,000 cubic meters of desalted Red Sea water per day to the drinking water supplies of Jeddah, Saudi Arabia. Experience to date with the design, construction, installation, and operation of the plant has been consistent with expectations.
W80-01252

COMPRESSOR TECHNOLOGY AS RELATED TO VARIOUS FREEZE DESALINATION PROCESSES,
Chicago Bridge and Iron Co., Oak Brook, IL.
J. S. Andrepont, J. L. Seale, and W. A. Carpenter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-119241, Price codes: A05 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, October 1979, 75 p. OWRT C-80327-S No (8559)(1), 14-34-0001-8559.

Descriptors: *Desalination apparatus, *Desalination processes, Freezing, Crystallization, *Compressor technology, Desalting.

The compressor requirements of various freeze desalination processes are dicussed and operating requirements of each compressor are included for plant size of 0.1, 1, 5 and 10 million gallons per day. The compressors involved in the various cycles fall into three categories: Closed loop refrigeration systems, open loop systems, and the water vapor compressor used in the vacuum freeze vapor compression process. Closed loop refrigeration compressors are standard, commercially available, refrigeration compressors. Open loop refrigeration compressors are also available but will require special attention due to erosion and corrosion problems associated with salt water entrainment. The water vapor compressor for the VFVC process is not commercially available at this time and will require a considerable amount of development work to produce a compressor suitable for this application.
W80-01374

PROCESS FOR THE DESALINATION OF SALT CONTAINING WATER,
D. W. Coillet.
U.S. Patent No 4,161,445, 5 p, 1 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 665-666, July 17, 1979.

Descriptors: *Patents, *Water treatment, *Desalination, *Water purification, *Sea water, Reverse osmosis, Ion exchange, Resins, Solar radiation, Thermal properties, Regeneration.

A water source such as sea water containing solar heat is passed through a reverse osmosis membrane and the permeate therefrom is passed through a bed of ion exchange resin to remove the contaminants and render the water potable. The solar heat present in the sea water is removed from the water prior to passage of the water through a reverse osmosis membrane and utilized to thermally regenerate the ion exchange resin. (Sinha-OEIS)
W80-01495

PROCESS FOR THE TREATMENT OF GROUND WATER,
D. W. Coillet.
U.S. Patent No 4,161,446, 6 p, 1 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 666, July 17, 1979.

Descriptors: *Patents, *Water treatment, *Desalination, *Water purification, *Water pollution treatment, Potable water, Ion exchange, Groundwater resources, Resins, Reverse osmosis, Thermal properties, Regeneration.

A water source such as ground water which contains impurities such as silica, sulfates, etc. and also contains geothermal heat is passed through a bed of anion exchange resin and a bed of cation exchange resin prior to treatment by passage over a thermal ion exchange desalination resin. The desalination resin is subsequently regenerated by hot water and the used regenerant is passed through a reverse osmosis membrane to remove the contaminants and thereby providing potable water. (Sinha-OEIS)
W80-01496

3B. Water Yield Improvement

GROUND-WATER STORAGE FOR CALIFORNIA WATER PROJECT,
California State Dept. of Water Resources, Los Angeles. Southern District.
For primary bibliographic entry see Field 6E.
W80-01282

3D. Conservation In Domestic and Municipal Use

HOUSEHOLD DEMAND FOR WATER AND POLICIES TO ENCOURAGE CONSERVATION,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
L. Clouser, and L. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-111891, Price codes: A01 in paper copy, A01 in microfiche. Purdue University Water Resources Research Center Technical Report No. 124. August 1979. 67 p, 11 Tab, 41 Ref, 1 Append.

Descriptors: *Water conservation, *Water demand, *Water supply, *Domestic use, Population, Water shortage, Water storage, Water policy, Building codes, Water rates, *Water saving devices, *Water subsidies.

When a domestic water shortage occurs, the alternative usually investigated is increasing the supply, rather than decreasing the household demand. The authors studied two rural Indiana communities who were experiencing a water supply problem to determine the alternatives. People in general were not aware of available water saving devices for the home, and felt that water intensive appliances, such as dishwashers, automatic washing machines, etc., should be included in their present standard of living. The authors estimated that in a community of 600-1000 population, decreasing the demand for water by employing water saving kits would decrease the pumpage for the community by about 7.4 million gallons per year. The saving in water bills per household would range from $40-$60 annually or approximately $22,000 for the community. The alternative of increasing supply by digging a new well and providing more storage would cost about $1 million and raise minimum charges by 78 to 104 percent. It is suggested that subsidizing the installation of water saving kits could be accomplished for about $2000. Other means of controlling demand considered are taxation, regulation, and pricing. (Wiersma-Ind)

W80-01203

A STUDY OF FACTORS RELATED TO THE IMPLEMENTATION AND USE OF WATER CONSERVATION TECHNOLOGY IN MISSISSIPPI,
University of Southern Mississippi, Hattiesburg. School of Business Administration.
P. Cartee, and D. C. Williams, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-112709, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University, Mississippi State, Report, October 1979. 49 p, 14 Tab, 34 Ref, 3 Append. OWRT-A-120-MISS (1), 14-34-0001-9026.

Descriptors: *Water conservation, *Domestic water, *Municipal water, *Water rates, *Standards, Local governments, State governments, Mississippi, Homebuilders associations, Speculatively built single-family houses, Municipal water supplies, Low-flow shower heads, Water saving toilets, Faucet aerators, Water saving appliances, Insulated hot water lines, Energy efficient hot water heaters, Single family marketing.

This project was purposed with determining the awareness, status, and current usage of domestic water conserving technology in selected areas of Mississippi. Home builders and municipal officials were surveyed to gather pertinent data. Home builders were found to exercise the greatest selection responsibility in choosing water consuming equipment in speculatively-built houses followed next by the plumbing contractor. Only 60 percent of the builders indicated the use of one or more water conserving items in their construction, mostly water conserving toilets and energy efficient hot water heaters. Conservation aspects of equipment were not found to influence builder choices significantly as they felt it added little to marketability. Only about 22 percent felt that buyers would pay over $100 for such items. Local codes were not viewed as a deterrent. Almost all of the municipalities viewed their water supplies as adequate; none had mandated water conserving equipment requirements; most used the declining block rate structure and felt that rate manipulation would not produce significant savings. Attempts at mandated, state level water conservation via equipment regulations have not been successful.
W80-01259

RESIDENTIAL WATER CONSUMPTION IN RENO - SPARKS, NEVADA,
Nevada Univ. System, Reno. Water Resources Center.
V. L. Gupta, and D. E. Carlson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116312, Price codes: A04 in paper copy, A01 in microfiche. Publication No 41059, October 1979, 45 p, 10 Fig, 5 Tab, 13 Ref. OWRT B-095-NEV (1), 14-34-0001-7167.

Descriptors: *Water conservation, *Domestic water, *Water loss, Equipment, Water delivery, Pipes, Plumbing, *Residential water consumption, Opinion survey, Nevada, Reno-Sparks(NV).

This report describes the results of a limited-scale field survey conducted in Reno-Sparks, Nevada concerning the general patterns of the indoor and outdoor components of residential water consumption. A total of twenty-three homes were metered in two-week intervals to obtain the data base. Coupled with this effort was an attitude and opinion survey directed toward a randomly selected group of 1000 residents in the study area, with about 34 percent responding to the inquiries. A majority of the respondents indicated a strong desire toward the implementation of some form of water conservation.
W80-01377

3F. Conservation In Agriculture

BUBBLER SPRINKLER,
R. W. von Lutzow.
U.S. Patent No 4,159,805, 4 p, 4 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 984, No 1, p 95, July 3, 1979.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Irrigation practices, Irrigation efficiency, Application equipment, Flushing.

A new and improved bubbler head is provided for a water irrigation system which is formed of nonmetallic parts, such as from suitable plastics which do not corrode or are not effected by electrolysis and may be easily adjusted and retain its adjustment for long periods of time to provide the right amount of water for the area being watered. The bubbler head is easily hand adjusted to remove any clogging or water flow restricting debris by a slight turning of the bubbler head which flushes out the internal parts of the bubbler after which the bubbler head is turned back to its desired water controlled flow. (Sinha-OEIS)
W80-01474

ALIGNMENT CONTROL APPARATUS FOR A SELF-PROPELLED IRRIGATION SYSTEM,
Tumac Industries, Inc., Colorado Springs, CO. (Assignee).
J. R. McConnell.
U.S. Patent No 4,161,185, 10 p, 8 Fig, 19 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 579-580, July 17, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Control systems, Irrigation practices, Irrigation efficiency, Equipment, Valves, Alignment control.

An alignment control for a self-propelled irrigation system maintains adjacent pipe segments of the system in a predetermined alignment and includes an elongated actuation arm pivotally mounted near its center for movement about a vertical axis. One end portion of the arm is spring biased against one of the pipe segments and the other end is operably connected to a control valve which runs one of the self-propelled support towers of the irrigation system. In the preferred embodiment, the end portion abutting the pipe segment is bifurcated into two legs which vertically straddle a section of the pipe segment. The spring biases one of the legs toward an abutting relationship with the pipe section making the actuation arm very sensitive and responsive to misalignments of the adjacent pipe segments. The valve housing for the control valve is also mounted for pivotal movement and the second end portion of the actuation arm is adjustably connected to the valve control member so that the alignment control system can be adjusted to maintain adjacent pipe segments at any desired relative angle to each other. (Sinha-OEIS)
W80-01489

WATERING DEVICE,
J. E. Hill.
U.S. Patent No 4,161,290, 3 p, 4 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 616, July 17, 1979.

Descriptors: *Patents, *Irrigation, *Application equipment, Irrigation practices, Irrigation efficiency, Flow control.

A fitting coupled to a water source comprises an orifice, means for regulating the quantity of water passing through it, an abutment for the water and a laterally displaced water outlet means. The fitting has a mixing or turbulence-causing chamber to allow for the bubbling release of water. (Sinha-OEIS)
W80-01491

EMITTER,
C. Bentley.
U.S. Patent No 4,161,291, 7 p, 15 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 616, July 17, 1979.

Descriptors: *Patents, *Irrigation, *Application equipment, Irrigation practices, Irrigation efficiency, Flow control, *Drip irrigation, Emitters.

An emitter for use in drip irrigation comprises a chamber and a resilient element having opposite faces mounted in the emitter chamber with the first face confronting a surface of the emitter chamber. The surface of the emitter chamber and the first face cooperate to define a restricted fluid passage. The emitter body has an inlet for supplying water under pressure to the emitter chamber and an outlet leading from the fluid passage. The resilient element as an aperture between the second face and the fluid passage so that water can pass from the inlet through the aperture and the fluid passage to the outlet. The pressure drop across the aperture is increased to hold the first face of the resilient element against the surface of the emitter chamber to maintain the integrity of the fluid passage. This may be accomplished by utilizing one or more slits for the aperture or by providing a suitable valve member in the aperture. (Sinha-OEIS)
W80-01492

CENTER PIVOT IRRIGATION SYSTEM HAVING APPARATUS FOR IRRIGATING CORNERS,
Lockwood Corporation, Gering, NE. (Assignee).
H. L. Holloway, and E. M. Norum, Jr.
U.S. Patent No 4,161,292, 16 p, 7 Fig, 2 Tab, 14 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 617, July 17, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Sprinkler irrigation, *Application equipment, Irrigation practices, Irrigation efficiency, Control systems, Timing, Nozzles.

A center pivot irrigation system has first and second auxiliary nozzles, or end guns, alternately operable for irrigating substantial portions of corner regions. The system includes a main pipeline sprinkler having main fluid discharge nozzles for irrigating a central, generally circular area, and the end guns are connected to the main pipeline sprinkler and draw water from it. When a corner is approached, one of the end guns is actuated while maintaining actuation of the main fluid discharge nozzles. A short period of time thereafter, the second end gun is actuated, and the pivotal rate of the main pipeline sprinkler is reduced to zero. At this time the main fluid discharge nozzles and the first end gun are closed, thereby providing all of the water from the main pipeline sprinkler to the operating end gun. After a predetermined time period, the second end gun is inactivated, the first gun and the main nozzles are reactivated, and the system is pivoted to a new orientation. After several such sequences and the corner has been passed, only the main nozzles are actuated until another corner is approached. Timers are provided for determining the duration of the periods during which the water is being discharged through the various nozzles to allow effective control of the amount of irrigation water discharged. (Sinha-OEIS)
W80-01493

SPHERICAL IRRIGATION PIPE COUPLING WITH REPLACEABLE SEAL,
Gifford-Hill and Co., Inc., Spokane, WA. (Assignee).
J. E. Hansen.
U.S. Patent No 4,161,331, 10 p, 4 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 629-630, July 17, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Pipes, *Joints(Connections), Sealants, Application equipment, Irrigation practices, Irrigation efficiency, Couplings, Articulation.

Irrigation pipe couplings for movable irrigation systems include a spherical coupling structure that allows articulation of sections of the irrigation pipe during operation of the irrigation system. A sealing element is provided that maintains a positive seal when the various sections of irrigation pipe are static or are moving. The internal and external components of the coupling structure and the sealing element of each of the couplings cooperate in such manner that the sealing elements are easily and quickly replaceable should they become worn or damaged. It is not necessary to cause longitudi-

nal separation of the sections of pipe in order to achieve replacement of the sealing element. A portion of the external part of the coupling structure provides support for one extremity of one of the pipe sections that are couples, both in normal operation and during replacement of the sealing element. (Sinha-OEIS)
W80-01494

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

PRODUCTION OF REPRODUCTIVELY LIMITED GRASS CARP FOR BIOLOGICAL CONTROL OF AQUATIC WEEDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Agricultures.
W. L. Shelton, and G. L. Jensen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-114713, Price codes: A09 in paper copy, A01 in microfiche. Water Resources Research Institute Auburn University, WRRI Bulletin 39, September 1979, 174 p, 2 Fig, 21 Tab. OWRT B-075-ALA (1), 14-34-0001-8055.

Descriptors: *Aquatic, *Weed control, *Fish, Fish genetics, *Fish reproduction, *Grass carp, Sex reversing, Aquatic macrophytes.

The need for a biological aquatic weed control is increasingly evident as the cost-effectiveness and environmental concerns make chemical treatment less desirable. The grass carp, a native fish of Southeast Asia is an effective consumer of aquatic macrophytes. However, potential adverse environmental impact must be considered when an exotic animal is proposed for introduction. Unwanted reproduction and subsequent naturalization is the greatest fear that biologists in the U. S. hold for grass carp. No reproduction would be possible if only a single sex were stocked but an efficient technique to monosex grass carp has not been available. This study applied experience gained with hormone sex reversing of tilapias and modified the methods to suit specializations of grass carp. Functional sex reversal was the objective of the study but the ultimate goal was to use these fish as brood fish that would yield only single sex offspring. This approach depends on the stability of the sex determining mechanisms but if it is substantiated sufficient numbers of monosex fish can be inexpensively produced.
W80-01254

EFFECTS OF DRAINAGE PROJECTS ON SURFACE RUNOFF FROM WETLAND TOPOGRAPHY OF THE NORTH CENTRAL STATES,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
I. D. Moore, and C. L. Larson.
Paper No. NCR 76-203 presented at the 1976 Annual Meeting of North Central Region, American Society of Agricultural Engineers and Manitoba Region, Canadian Society of Agricultural Engineering, Winnipeg. 21 p, 2 Fig, 17 Ref, Append, ASAE, St. Joseph, Michigan. OWRT-B-122-MINN (3), 14-31-0001-6092.

Descriptors: *Wetlands, *Drainage, *Flood flow, *Runoff, Environmental effects, Evaluation, Statistical methods, *North central states.

Drainage of wetlands has for many years been a controversial subject. The background to the problem is dicussed, in particular the allegation that drainage projects aggravate floods. Both statistical analysis of historical data and watershed modeling techniques are used. This paper shows that statistical analysis alone is incapable of resolving the problem at the present time. (Blake-Minn)
W80-01263

CHEMICAL COMPOSITION OF AQUATIC MACROPHYTES, I. INVESTIGATION OF ORGANIC CONSTITUENTS AND NUTRITIONAL POTENTIAL,
Guelph Univ. (Ontario). Coll. of Biological Science.
For primary bibliographic entry see Field 5C.
W80-01352

THE BIOLOGY OF CANADIAN WEEDS. 34. MYRIOPHYLLUM SPICATUM L.,
Minnesota Univ., St. Paul. Dept. of Botany.
S. G. Aiken, P. R. Newroth, and I. Wile.
Canadian Journal of Plant Science, Vol 59, No 1, p 201-215, January 1979. 19 Fig, 1 Tab, 65 Ref.

Descriptors: *Biology, *Speciation, *Aquatic weeds, *Water hyacinth, *Aquatic weed control, *Herbicides, *Eurasian watermilfoil, diseases, Growth rates, Distribution, Ecological distribution, Reproduction, Plant physiology, Habitats, Economic impact, Submerged plants, Canada, Lakes, Aquatic plants, Floating plants, Invasion, Competition, 2,4-D, Diquat, Paraquat.

An overview of Myriophyllum spicatum (Eurasian water-milfoil) and its particular occurrence in Canadian lakes and rivers covers species variation, economic importance, geographic distribution, habitat, history, growth and development, reproduction, hybrids, population dynamics, response to herbicides and other human manipulations, and response to parasites. This weed species was introduced from Eurasia and has spread throughout the U.S. and into British Columbia and lakes and rivers in eastern Canada along the St. Lawrence Seaway. M. spicatum is much more aggressive than native watermilfoils, M. verticillatum and M. exalbescens. Eurasian watermilfoil flourishes in eutrophic lakes and in waterways enriched with nutrients. It grows in 1-10 M water depths, whereas M. exalbescens is limited to 0.5-2.5 m and M. verticillatum is limited to 1-3 m. M. spicatum invades submerged aquatic plant communities and within two to three years, competitively displaces most other plants. It is highly susceptible to 2,4-D; control occurs in 48 h with 1.0 ppm 2,4-0 concentration, all plants are killed when exposed to five ppm treatments for only one h. Repeated mechanical harvesting, rototilling, diver-operated dredges, and water level drawndown have been used to control M. spicatum. No insect parasites in North America are known. Lake Venice disease, an attack by microorganisms, occurred in 1962 in Maryland populations, however, no specific pathogen has been found for this disease. (Danovich-Wisconsin)
W80-01362

PROCEEDINGS: STORMWATER MANAGEMENT MODEL (SWMM) USERS GROUP MEETING, NOVEMBER 13-14, 1978.
For primary bibliographic entry see Field 6A.
W80-01389

FLOOD PLAIN INFORMATION: CUCHARAS RIVER AND TRIBUTARIES, LA VETA, COLORADO,
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W80-01400

FLOOD PLAIN INFORMATION: CUCHARAS RIVER AND TRIBUTARIES, WALSENBURG, COLORADO,
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W80-01401

FLOOD PLAIN INFORMATION: GILMORE CREEK, BURNS VALLEY CREEK, PLEASANT VALLEY CREEK, VICINITY OF WINONA, MINNESOTA,
Army Engineer District, St. Paul, MN.
For primary bibliographic entry see Field 2E.
W80-01403

FLOOD HAZARD INFORMATION: ANIMAS RIVER AND HERMOSA CREEK, HERMOSA, COLORADO,
Army Engineer District, Sacramento, CA.
For primary bibliographic entry see Field 2E.
W80-01412

FLOOD HAZARD INFORMATION: COLORADO RIVER AND TRIBUTARIES: FRUITA, CO,
Army Engineer District, Sacramento, CA.
For primary bibliographic entry see Field 2E.
W80-01413

FLOOD HAZARD INFORMATION: YAMPA RIVER AND TRIBUTARIES, CRAIG, COLORADO,
Army Engineer District, Sacramento, CA.
For primary bibliographic entry see Field 2E.
W80-01414

FLOOD HAZARD INFORMATION: COLORADO RIVER AND TRIBUTARIES, GRAND JUNCTION, COLORADO,
Army Engineer District, Sacramento, CA.
For primary bibliographic entry see Field 2E.
W80-01415

THE WATER HYACINTH: FROM PROLIFIC PEST TO POTENTIAL PROVIDER,
National Space Technology Labs., NSTL Station, MS.
B. C. Wolverton, and R. C. McDonald.
Ambio, Vol 8, No 1, p 2-9, 1979. 6 Fig, 5 Tab, 30 Ref.

Descriptors: *Water hyacinth, *Invasion, *Aquatic weed control, *Beneficial use, *Waste water treatment, Aquatic weeds, Geographical regions, Growth rates, Productivity, Trophic level, Climatic zones, Eutrophication, Fertilizers, Nutrient removal, Water purification, Biomass, Benefits, Harvesting, Waste assimilative capacity, Bioaccumulation.

Although current infestations of water hyacinth (Eichhornia crassipes) in Florida, Louisiana, and Texas cover 700,000 waterway ha and cost these three states alone over $11 million/yr for control, studies show that water hyacinths can be beneficially used for large-scale nutrient removal and water purification. Domestic waste treatment chemical waste treatment, growth rate and harvesting, and product development to utilize biomass quantities care. All under review at present, water water hyacinth systems are limited to freshwater systems in warm climates. With a wastewater retention time of seven d, water hyacinths yearly reduce BOD 70% from 50 mg/l influent levels to 15 mg/l effluent levels. Suspended solids are reduced from 49 mg/l average influent levels to 14 mg/l effluent levels. Nutrients are reclaimed from the water and form plant biomass and water is restored to receiving stream quality. Water hyacinth's unique survival capacity enables it to absorb and concentrate heavy metals without visible toxicity signs. A system using water hyacinths and receiving 95,000 l/d chemically polluted wastewater, reduced BOD by 97% and COD by 88%. Water hyacinth harvesting and productivity studies show an overall average 46% increase in weight per week at maximum growth rates. Other products which can be made from water hyacinths include cattle feed supplements, protein concentrate for human food, organic fertilizer and soil conditioner, and biogas containing high methane percentage. (Danovich-Wisconsin)
W80-01457

DOWNSPOUT RECEIVER AND WATER DISPENSING DEVICE,
C. L. Sitarz.
U.S. Patent No 4,161,186, 4 p, 3 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 580, July 17, 1979.

Descriptors: *Patents, *Drainage water, *Storm runoff, Drainage systems, Storm drains, Subsurface drains.

Most towns and cities require that downspouts be disconnected from the main sewer system of the building and instead be arranged so that they discharge outwardly from the building in order to prevent overloading of the sewer system. This invention provides a substantially hollow receiver which is buried in the ground remote from the lower end of the downspout and is connected to the downspout by buried conduit. A pop-up type lid or cover is provided which normally rests flush upon the upper end of the receiver level with the ground, but which moves upwardly under water pressure when water is flowing through the downspout. This water is then discharged circumferentially around the periphery of the receiver so that wash-aways are prevented. When the water pressure drops, the lid or cover returns to the closed position by gravity or by a light spring if desired, thereby preventing the ingress of dirt, dust and the like into the receiver and also preventing accidents from occuring to people who might be walking in the general area of the receiver. (Sinha-OEIS)
W80-01490

4B. Groundwater Management

HYDROGEOLOGIC DATA FOR THE BEAR CREEK SUBSURFACE-INJECTION TEST SITE, ST. PETERSBURG, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. J. Hickey, and G. L. Barr.
Geological Survey open-file report 78-853, 1979. 53 p, 10 Fig, 17 Tab, 20 Ref.

Descriptors: *Injection wells, *Underground storage, *Artificial recharge, *Storm runoff, *Aquifer characteristics, Hydrologic properties, Water supply, Water demand, Test wells, Water quality, Hydrogeology, Petrology, Aquifer management, Florida, *St. Petersburg(FL).

Lithologic, hydraulic, geophysical, and water-quality data were collected at the Bear Creek subsurface-injection test site at St. Petersburg, FL. The data were collected to determine the feasibility of subsurface injection of storm runoff. An exploratory hole and five observation wells were constructed between October 1974 and April 1976. The lithology of the upper 185 feet at the test site is predominantly sand and marl. From 185 feet to 3,504 feet, limestone and dolomite predominate. Also, gypsum is present below 1.290 feet. Vertical intrinsic permeability, porosity, and compressibility of cores are reported. A 73-hour withdrawal test discharging 3,450 gallons per minute was run in the test injection well. At the site, chloride concentration in water from 192 to 340 feet, ranged from 150 to 680 milligrams per liter, and from 500 to 1,267 feet ranged from 16,000 to 20,000 milligrams per liter. Eleven additional wells near the test site were sampled for water quality. (Woodard-USGS)
W80-01419

HYDROGEOLOGIC DATA FOR THE SOUTH CROSS BAYOU SUBSURFACE-INJECTION TEST SITE, PINELLAS COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. J. Hickey.
Geological Survey open-file report 78-575, 1979. 87 p, 13 Fig, 27 Tab, 21 Ref.

Descriptors: *Injection wells, *Artificial recharge, *Aquifer characteristics, *Water quality, *Test wells, Aquifer management, Data collections, Sampling, Monitoring, Hydrologic data, Florida, *Pinellas County(FL).

One exploratory hole, a test injection well, and nine monitor wells were constructed at the South Cross Bayou test-injection site between January 1973 and October 1975. At the test site, the first 125 feet below land surface is predominantly limestone and clay; from 125 to 3,280 feet it is mostly limestone and dolomite. Gypsum is also present below 1,260 feet. Wells within about a 1-mi radius of the test injection site were sampled and analyzed to provide water-quality background data prior to anticipated long-term injection at the test site. Locations of the wells sampled are shown, reported construction data are given, and the chemical analyses of water from these wells are tabulated. Chloride concentration of water from the wells near the test site ranged between 9.8 to 290 mg/L. Reported depth of these wells ranged from 25 to 302 ft. (Woodard-USGS)
W80-01421

APPRAISAL OF UNCONTROLLED FLOWING ARTESIAN WELLS IN FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. G. Healy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-102239, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-95, 1978. 26 p, 7 Fig, 2 Tab.

Descriptors: *Artesian wells, *Aquifers, *Subsurface flow, Springs, *Florida, Discharge(Water), Water quality, Aquifer management, Aquifer characteristics, *Uncontrolled flowing wells.

An estimated 15,000 uncontrolled flowing wells, many discharging water of poor quality are wastefully discharging about 790 million gallons per day by surface and internal flow. Internal flow in principal problem areas have been identified in Brevard, Charlotte, Clay, De Soto, Duval, Flagler, Glades, Hendry, Hillsborough, Lee, Manatee, Martin, Nassau, and Sarasota Counties. In many areas, uncontrolled discharge over the years has caused a decline in the potentiometric surface locally and regionally, and a deterioration of the potable water aquifers. Programs for control of flowing wells are being carried on by State, county, municipal, or Federal agencies in 21 countries. (Woodard-USGS)
W80-01423

GROUND-WATER MONITORING AT SANTA BARBARA, CALIFORNIA, PHASE 1--COASTAL MONITOR-WELL INSTALLATION AND INITIAL MEASUREMENTS,
Geological Survey, Menlo Park, CA. Water Resources Div.
C. B. Hutchinson.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, microfiche $3.50, paper copy $3.50. Geological Survey open-file report 79-923, July 1979. 24 p, 7 Fig, 4 Tab, 6 Ref.

Descriptors: *Saline water intrusion, *Probability, *Drawdown, *Aquifers, *Observation wells, Pumping, Water analysis, Water quality, Dissolved solids, Chlorides, Aquifer characteristics, Groundwater movement, Hydrology, Well data, Lithologic logs, Aquifer management, Testing procedures, Monitoring, *Santa Barbara(CA).

Plans to reduce natural ground-water storage in the 7-square-mile Santa Barbara groundwater basin have caused concern about possible saltwater intrusion into the coastal freshwater aquifer. To give advance warning of such intrusion, two multipiezometer wells were installed along the coast, about half a mile and 1 mile from the pumping center. Each site contains four small-diameter wells, completed at depths between 95 and 800 feet, which monitor water levels and water quality in (1) the shallow zone above the producing zones, (2) the upper producing zone, (3) the lower producing zone, and (4) the deep zone below the producing zones. The wells were measured and sampled initially in September 1978 during a 2-million gallons per day pumping phase of the municipal supply wells. In the eight samples collected, dissolved-solids concentrations ranged from 450 to 6,290 mg/L and chloride concentrations ranged from 35 to 2,800 mg/L. At the site farther from the center of pumping, the well monitoring the upper producing zone was the only one with a water level below sea level, and it produced the water of poorest quality. At the site nearer the center of pumping, water levels in both producing zones and the deep zone were between 2 and 18 feet below sea level, with the water of poorest quality occurring in the lower producing zone. Although the dissolved-solids concentrations are high in several zones, the potential for saltwater intrusion can be reliably evaluated only after analysis of long-term records. (Woodard-USGS)
W80-01433

THE ALLOCATION OF PERCOLATING WATER UNDER THE OKLAHOMA GROUND WATER LAW OF 1972,
Tulsa Univ., OK.
For primary bibliographic entry see Field 6E.
W80-01552

WATER MANAGEMENT OF THE FUTURE: A GROUNDWATER STORAGE PROGRAM FOR THE CALIFORNIA STATE WATER PROJECT,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 6E.
W80-01553

BEYOND SECTION 858: A PROPOSAL GROUND-WATER LIABILITY AND MANAGEMENT SYSTEM FOR THE EASTERN UNITED STATES,
National Energy Law and Policy Inst., OK.
For primary bibliographic entry see Field 6E.
W80-01554

LONG-TERM WATER SUPPLY POTENTIAL, GREEN SWAMP AREA, FLORIDA,
Geological survey, Tallahassee, FL. Water Resources Div.
H. F. Grubb, and A. T. Rutledge.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-102270. Price codes: A05 in paper copy. A01 in microfiche. Geological Survey Water-Resources Investigations 78-99, 1979. 76 p, 37 Fig, 5 Tab, 29 Ref.

Descriptors: *Groundwater resources, *Surface-groundwater relationships, *Florida, *Swamps, *Water supply, Model studies, Hydrogeology, Simulation analysis, Inflow, Discharge(Water), Aquifer characteristics, Pumping, Water yield, Drawdown, Groundwater recharge, Leakage, Induced infiltration, *Green Swamp area(FL), *Floridan aquifer.

The Green Swamp is an 870 square-mile area of interspersed swamps and flat uplands located in central Florida about 20 miles west of Orlando and about 30 miles northeast of Tampa. Estimates of principal water budget items are (1) inflow, 52.10 inches of rainfall and less than one-half inch of ground-water inflow and (2) outflow, 10 inches of surface runoff, 2 inches of ground-water outlfow, and 40 inches of evapotranspiration. The effects of large-scale pumping from the Floridan aquifer were evaluated using a steady-state finite-difference ground-water flow model. The average simulated drawdown in the modeled area was 2 feet for a withdrawal rate of 91 million gallons per day from 6 pumping centers, 4 feet for a withdrawal rate of 183 million gallons per day from 12 pumping centers, and 6 feet for a withdrawal rate of 274 million gallons per day from 18 pumping centers. The 274 million gallons per day is equivalent to the estimated natural ground-water outflow plus about 45 percent of the runoff from the Green Swamp. (Woodard-USGS)
W80-01588

SALTWATER ENCROACHMENT IN THE '600-FOOT' AND '1,500-FOOT' SANDS OF THE BATON ROUGE AREA, LOUISIANA, 1966-78, INCLUDING A DISCUSSION OF SALTWATER IN OTHER SANDS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W80-01594

4C. Effects On Water Of Man's Non-Water Activities

A COMPARATIVE APPLICATION OF SEVERAL METHODS FOR THE DESIGN OF STORM SEWERS,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
B. Burke, and D. D. Gray.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-114721, Price codes: A07 in paper copy, A01 in microfiche. Technical Report No 118, August 1979. 134 p, 40 Fig, 42 Tab, 28 Ref, 2 Append. OWRT A-057-IND (1), C-6106 (No 5213) (12).

Descriptors: *Urban drainage, *Drainage systems, *Unit hydrographs, *Rational formula, Urban runoff, Storm runoff, Sewers, Storm drains, Simulated rainfall, Peak discharged, Precipitation intensity.

Four methods which may be employed in the design and analysis of urban drainage systems were investigated:the National method, the Illinois Urban Drainage Area Simulator (ILLUDAS), the Soil Conservation Curve Number Method (CN) and the instantaneous unit hydrograph of Sarma, Delleur, and Rao (SDR). These methods were applied to two subdivisions: Fair Oaks Estates located in Carol Stream, Illinois, and Bar Berry Heights in West Lafayette, Indiana. Recommendations for the most effective use of each method are presented. In the comparisons made it was concluded that ILLUDAS was the most useful. The required input data are not excessive and the program is relatively easy to apply for various conditions. Use of the rational method is not recommended because it requires too much engineering judgement and too many hand calculations to allow the investigation of many differing conditions or alternative designs. Volumes computed using the CN method were found to be low when compared to the ILLUDAS results. The peak flow rates determined by the SDR method were also low. (Wiersma-Ind)
W80-01253

WATER QUALITY AND CONSTRUCTION: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
July 1979. 108 p, 53 Ref, 13 Tab, 13 Fig. EPA P004198010.

Descriptors: *Water quality, *North Carolina, *Sediment control, *Erosion, *Stream erosion, *Erosion control, *Sedimentation Pollution Control Act of 1973, *Construction, *Surface runoff, Water management, Sedimentation, Bank erosion, Stream degradation, Channel erosion, Structural improvements, Road construction, Water pollution, Surface drainage.

This report, part of North Carolina's Water Quality Management Plan, is an assessment of the erosion and sedimentation caused by construction activities within North Carolina. More than 15,000 acres in the state are exposed each year by construction activities. Non-highway construction activities are centered in the more metropolitan counties while highway construction is widely distributed across the state. Impacts from construction activities are centered around excessive sedimentation which causes biological and physical degradation of streams, ponds and lakes. Secondary impacts from construction occur once construction has ceased and include the following: streambank degradation, erosion of roadbanks and roadsides, and sediment from unpaved roads. Three basic categories of practices exist for preventing sediment eroded on construction sites from entering watercourses: surface protection measures, runoff water control measures and sediment trapping measures. The Sedimentation Pollution Control Act of 1973 (the SPCA) is the state's regulatory law on which the most significant and effective programs are based. Federal programs which influence erosion control are wastewater facility construction grants, the National Environmental Policy Act and the dredge and fill material permit program. Erosion control has improved since the SPCA was enacted in 1973 but some significant problems still remain. More attention needs to be placed on every aspect of erosion control, from submission and design of plans to the maintenance of devices that are used for erosion control. (Iervolino-NC)
W80-01398

WATER QUALITY AND URBAN STORMWATER: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
July 1979. 89 p, 55 Ref, 29 Fig, 3 Tab, 3 Append. EPA P004298010.

Descriptors: *Urban hydrology, *Water quality, *Urban storm water, *Storm water, *Urban stream pollution, *Water pollution, *Water pollution control, *North Carolina, *Water quality control, Urban drainage, Urban runoff, Storm runoff, Surface runoff, Water pollution sources, Water pollution effects, Water pollution treatment, Water management(Applied).

This report, part of North Carolina's Water Quality Management Plan, is an assessment of the pollution caused by urban stormwater in North Carolina. Information was gathered on: (1) extent of urbanization in the state; (2) sources and typical impacts of urban pollutants; (3) ways to mitigate adverse impacts; (4) programs which currently affect stormwater control and their effectiveness; and (5) continuing water quality problems as demonstrated through monitoring results. In 1970 only 23.9% of the state's population lived in urban areas, in contrast to 58.3% nationwide. Sources of urban stream pollution include atmospheric sources, transportation residue, particulates accumulation, urban litter, chemicals usage, fertilizer and pesticide usage, enteric microorganism sources, unpermitted point sources, construction activities and streambank degradation. The impacts of this pollution are: oxygen depletion, nutrient over-enrichment, toxics and enteric microorganism contamination, sediment accumulation, biological degradation and altered hydrologic characteristics. The plan also reports on the following studies which have been conducted to determine the extent of degradation of urban streams; Third Fork Creek Study, Triangle J Study, Land of Sky Study, Winston-Salem Study, and the Raleigh Area Study. Both physical/chemical measurements and biological sampling were taken in all the studies. The studies have shown that, under present conditions, almost all urban streams will be unable to meet the 1983 water quality standards. The following practices are recommended: street cleaning, catch basin cleaning, covering chemical stockpiles, small-scale detention basins, erosion control and litter control. (Iervolino-NC)
W80-01399

EFFECTS OF PAVED SURFACES ON RECHARGE TO THE FLORIDAN AQUIFER IN EAST-CENTRAL FLORIDA--A CONCEPTUAL MODEL,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. H. Tibbals.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-301 318, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-76, 1978. 42 p, 10 Fig, 3 Tab, 8 Ref.

Descriptors: *Groundwater recharge, *Paving, *Effects, *Artesian aquifers, *Model studies, Computer models, Analytical techniques, Equations, Hydrogeology, Aquifer characteristics, Potentiometric level, Rainfall-runoff relationships, Florida, *Floridan aquifer, *East-Central Florida.

The proportionate amount of surface area that can be paved in Floridan aquifer recharge areas in east-central Florida without reducing the net recharge to the Floridan aquifer is a function of many variables that include rainfall, depth to water table, depth to potentiometric surface of the Floridan, evaporation from paved areas, evapotranspiration from unpaved areas, runoff, pattern of paving, and leakance coefficient of the confining beds. Equations that incorporate those variables, except pattern of paving, are developed and coupled to produce a conceptual model that estimates relative amounts of water available for recharge and percentage of unpaved area below which Floridan aquifer recharge rates must increase. The model is not intended to be used as a basis for engineering design. Rather, its purpose is to show approximate mathematical interrelations of rainfall, runoff, evapotranspiration, percentage of paving, and Floridan aquifer recharge, and to make quantitative estimates of amounts of water available for Floridan aquifer recharge before and after paving. The allowable percentage of paving calculated in four examples ranges from 86.8 percent to 3.6 percent. (Woodard-USGS)
W80-01428

A DWINDLING WATER SUPPLY AND THE INDIAN STRUGGLE TO RETAIN ABORIGINAL AND WINTERS DOCTRINE WATER RIGHTS.
United Effort Trust, Inc., Washington, DC.
For primary bibliographic entry see Field 6E.
W80-01576

4D. Watershed Protection

RUNOFF AND EROSION REDUCTION VIA DRAINAGE AND INCREASED INFILTRATION,
Pennsylvania State Univ., University Park, Coll. of Agriculture.
A. R. Jarrett, and J. R. Hoover.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-111917, Price codes: A04 in paper copy, A01 in microfiche.

Descriptors: *Runoff, *Erosion control, *Drainage, *Infiltration, Soils, Rainfall-runoff relationships, Water table, Soil profiles, Subsurface drainage, Moisture, Laboratory tests, Methodology, *Erosion reduction, *Soil air, Nonpoint source pollution, Air entrapment, Fragipan, Tillage, Gas pressure.

The study investigated the effect of soil air entrapment on filtration runoff and erosion and the possibilities of reducing the negative effects. Four laboratory studies are reported. An infiltration model for infiltration under trapped air conditions based on a modified Green and Ampt (1911) equation was developed. Infiltration of high intensity rainfall into soils, containing shallow water tables or relatively impermeable layers, is reduced and in some cases virtually stopped if the soil air cannot move laterally to a venting location. The release of entrapped soil air through subsurface drainage systems placed at the depth of the restrictive layer or through surface soil pores can increase the infiltration rate where up to twice as much of the rainfall will enter the soil during short duration summer storms which often occur when the soil is relatively dry. This enhanced infiltration reduces the quantity of surface runoff resulting in less erosion and providing a method of nonstructural flood control on some small watersheds. (Tsong-Penn)
W80-01202

WATER QUALITY AND AGRICULTURE: A MANAGEMENT PLAN,
North Carolina Soil and Water Conservation Commission, Raleigh. Div. of Land Resources.
For primary bibliographic entry see Field 5G.
W80-01393

WATER QUALITY AND FORESTRY: A MANAGEMENT PLAN.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5G.
W80-01396

WATER QUALITY AND CONSTRUCTION: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 4C.
W80-01398

THE EFFECT OF MAINTENANCE ON STORM WATER DETENTION BASIN EFFICIENCY,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-01582

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

THE DETERMINATION OF CYANIDE ION IN NATURAL WATERS WITH A SELECTIVE ION ELECTRODE,
Southern Illinois Univ. at Edwardsville. Dept. of Chemistry.
D. G. Rands, and R. L. Bain.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-113590, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois, Urbana Research Report No. 143, October 1979. 18 p, 5 Tab, 6 Ref. OWRT-A-089-ILL (1), 14-31-0001-8015.

Descriptors: *Water analysis, *Ions, *Electrodes, *Analytical techniques, Laboratory equipment, *Cyanide ion concentration, Natural waters.

The analysis of cyanide ion in natural water systems is complicated by the fact that natural waters contain certain metal ions which form extremely stable metal-cyano complexes. Current methods involve distillation techniques to separate cyanide from the samples in order to permit the anlaysis. However, certain metalcyano complexes are so stable thermodynamically and release complexed cyanide so slowly that even those methods are not very satisfactory. We have investigated an approach to secure the release of cyanide ion in the water sample so that a direct measurement with a selective ion electrode can be used. The proposed technique is based upon the addition of an organic ligand to the sample which will form a metal complex sufficiently stable to release a quantitative amount of cyanide from metal-cyano complexes. We have shown that the complexing agents investigated will release 60-80% of complexed cyanide during simultaneous reflux and irradiation by a mercury lamp. Evidently this represents a state of equilibrium between complexed ligand and cyanide. The complexing agents, therefore, do not form metal complexes sufficiently stable to free enough cyanide ion to permit an analysis for the total cyanide ion concentration.
W80-01256

MICROBIOLOGICAL STUDIES ON THE QUALITY OF URBAN STORMWATER RUNOFF IN SOUTHERN ONTARIO, CANADA,
Ontario Ministry of the Environment, Rexdale (Ontario). Lab. Services Branch.
A. A. Qureshi, and B. J. Dutka.
Water Research, Vol 13, No 13, No 10, p 977-985, 1979. 5 Fig, 3 Tab, 18 Ref.

Descriptors: *Urban runoff, *Microorganisms, *Microbiology, *Canada, Bacteria, Pathogenic bacteria, Fungi, Indicators, Bioindicators, Coliforms, E. Coli, Streptococcus, Pseudomonas, Water quality, Sampling, On-site data collections, Data processing, Cities, Runoff, Storm runoff, *Ontario(Canada).

The microbiological quality of urban stormwater runoffs was investigated at three different locations in Southern Ontario, Canada. Microbial densities in these waters were similar to those found in dilute raw wastewaters and, therefore, they represent a potential health hazard. The recovery of pathogenic bacteria (Pseudomonas aeruginosa and salmonellae) furthe r substantiated the existence of health hazards. There appeared to be little relationship between the duration, intensity, and amount of rainfall and the occurrence of peak microbial populations. As a result, no typical pattern of time-related distribution of indicator and pathogenic bacteria could be established in this investigation. This suggests that 'initial flushing' has minimal effect on the microbiological quality of an individual storm event. Furthermore, the results indicated the seriousness of urban stormwater runoffs as a major factor in nonpoint source pollution of receiving waters and that it would be illogical to disinfect specific portions of these runoffs for removing health hazards as there was no predictable pattern of pathogen occurrence. (Sims-ISWS)
W80-01283

STATISTICAL ASSESSMENT OF INORGANIC NITROGEN IN A SMALL RIVER SYSTEM,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 5C.
W80-01284

IMPACT OF WESTERN COAL MINING--I. CHEMICAL INVESTIGATIONS OF A SURFACE COAL MINE SEDIMENTATION POND,
Montana State Univ., Bozeman. Dept. of Microbiology.
For primary bibliographic entry see Field 2K.
W80-01285

AN INVESTIGATION OF THE HEAVY METAL CONTENT OF THE WATER AND SEDIMENTS IN A RESERVOIR SUPPLYING DRINKING WATER TO A MAJOR MINING CENTER,
W. S. and L. B. Robinson Univ. Coll., Broken Hill (Australia).
A. J. Coggins, K. D. Tuckwell, and R. E. Byrne.
Environmental Science and Technology, Vol 13, No 10, p 1281-1285, October 1979. 3 Fig, 5 Tab, 25 Ref.

Descriptors: *Heavy metals, *Mining, *Reservoirs, *Sediments, *Australia, Sampling, Chemicals, Chemical analysis, Cadmium, Lead, Zinc, Copper, Manganese, Iron, Hydrogen ion concentration, Potable water, Water quality, Water supply.

Water and sediment samples were collected from a reservoir that supplies 30% of the domestic water use of a major lead-silver-zinc mining region. The samples were analyzed for cadmium, lead, zinc, and copper. Samples showed varying degrees of contamination by these elements, although measured levels in the water were below the World Health Organization limits for drinking water. Solution-sediment interactions in the catchment and reservoir were examined and showed a marked tendency for metals to be removed from solution into the underlying sediment. The relative effects of iron and manganese hydrous oxides, organic material, and clays on the distributions of each metal were examined. (Sims-ISWS)
W80-01292

NOTES ON MUDDY ODOUR. I SENSORY PROPERTIES AND ANALYSIS OF 2-METHYLISOBORNEOL IN WATER AND FISH,
Helsinki Univ., (Finland). Dept. of Limnology.
P. E. Persson, and R. K. York.
Aqua Fennica, Vol 8, p 83-88, 1978. 4 Fig, 10 Ref.

Descriptors: Freshwater fish, Pike, Bioassay, Laboratory tests, *Mud, Muddy odors, *Taste, *Taste producing algae, *2-methylisoborneol, Phytoplankton, Fish food, Public health, Helsinki, Finland, Winnipeg, Canada.

The muddy odour compound 2-methylisoborneol (MIB) was synthesized and its sensory properties were studied. In water, the odour threshold recognized by 75% of the judges varied in two independent experiments between 0.018-0.020 microg/l. The concentrations detected by a statistically significant percentage of the judges were 0.027=0.045 microg/l. In the flesh of pike (Esox lucius) the corresponding thresholds were 0.07 microg/l and 0.06 microg/l, respectively. In concentrations above 10 microg/l the musty or muddy odour of MIB is replaced by a camphorous smell. In the concentration range 0.01-10.0 microg/l the odour intensity as scored by the judges is proportional to the concentration, enabling the quantitation of MIB in water and fish by sensory methods. (See also W80-01317) (Katz-EIS)
W80-01316

NOTES ON MUDDY ODOUR. II UPTAKE OF 2-METHLISOBORNEOL BY RAINBOW TROUT (SALMO GAIRDNERI) IN CONTINUOUS FLOW AQUARIA,
Helsinki Univ. (Finland). Dept. of Limnology.
P. E. Persson, and R. K. York.
Aqua Fennica, Vol 8, p 89-90, 1978. 1 Tab, 11 Ref.

Descriptors: *Rainbow trout, Bioassay, Laboratory tests, Mud, *Muddy odors, Taste, Taste-producing algae, *2-methylisoborneol, Phytoplankton, Public health, Recreation, Fish food, Path of pollutants, Alimentary absorption.

Preliminary uptake experiments with rainbow trout (Salmo gairdneri) in continuous flow aquaria containing the muddy odour compound, 2-methylisoborneol, indicate the alimentary tract of the fish as an additional route of uptake of muddy odour, assuming importance when the fish are feeding . Muddy odour compounds dissolved in water also contribute to the tainting. (See also W80-01316) (Katz-EIS).
W80-01317

POLYCHLORINATED BIPHENYLS (PCB'S) IN PUGET SOUND: PHYSICAL/CHEMICAL ASPECTS AND BIOLOGICAL CONSEQUENCES,
Washington Univ., Seattle.
S. P. Pavlou, R. N. Dexter, and W. Hom.
In: The Use, Study and Management of Puget Sound, A Symposium, March 23-25, 1977, University of Washington, Seattle, p. 100-133, 1977. 5 Fig, 9 Tab, 48 Ref.

Descriptors: *Arochlor, *Polychlorinated biphenyls, Water pollution effects, *Path of pollutants, Sediments, Phytoplankton, Toxicity, Bioassays, *Puget sound, Seattle, Washington, Estuaries, Sediments, Chemical analysis, Chemical properties.

The physical and chemical aspects of PCB's in Puget Sound, especially the area near Seattle, Washington, and their biological consequences were explained in detail. A project was initiated to study the distribution of PCB in Puget Sound. The project included a baseline assessment of PCB in the major subregions of Puget Sound and laboratory investigations to evaluate their accumulation in marine phytoplankton and their toxicological impact to algal growth. The data collec ted suggest that accumulation on these various marine components, including biological uptake, is predominantly governed by equilibrium, partitioning of the chemicals between suspended phase and ambient water. (Katz-EIS).
W80-01318

AN ASSESSMENT OF THE EFFECTS OF SUBTIDAL SEWAGE OUTFALLS ON INTERTIDAL MACROFAUNA OF SEVERAL CENTRAL PUGET SOUND BEACHES,
Washington Univ., Seattle.
J. W. Armstrong, R. M. Thom, C. P. Staude, and K. K. Chew.
In: The Use, Study and Management of Puget Sound, A Symposium, March 23-25, 1977. University of Washington, Seattle, p. 177-199, 1977. 7 Fig, 7 Tab, 30 Ref.

Descriptors: *Animal populations, *Water pollution effects, Benthos, Intertidal, Animal groupings, Domestic wastes, Sewage, Washington, Seattle, *Puget sound, Statistical methods, Effluents, Effluent streams, Invertebrates.

A two year study of the intertidal macrofaunal communities at four beaches adjacent to the

sewage outfalls of the Municipality of Metropolitan Seattle, (Metro) and one control beach. An attempt was made to identify the existence of waste water related stresses. The study showed no measurable effects of waste water on the in tertidal macrofauna. The differences noted among the communities on each beach were positively correlated with differences in the suitable habitat on each beach. (Katz-EIS).
W80-01320

IMPACT OF SEWAGE ON BENTHIC MARINE FLORA OF THE SEATTLE AREA: PRELIMINARY RESULTS,
Washington Univ., Seattle.
R. M. Thom, J. W. Armstrong, C. P. Staude, and K. K. Chew.
In: The Use, Study and Management of Puget Sound, A Symposium, March 23-25, 1977, University of Washington, Seattle, p 200-220, 1977. 5 Fig,10 Tab, 18 Ref.

Descriptors: *Intertidal arlas, *Beaches, *Marine plants, *Water pollution effects, *Plant groupings, Domestic wastes, *Sewage, Washington, Seattle, *Puget sound, Statistical methods, Marine algae, Diatoms, Species diversity, Biomass.

The macro- and microflora of five Seattle beaches, four adjacent to submerged sewer outfalls and one control, were made for two years. The study was to provide baseline information regarding the intertidal algae of the Seattle area and to determine the effects of sewage on the intertidal flora. Minor differences were observed between the algal populations at the different beaches. The ability to quantify these differences was hampered by the variability inherent in most types of community analysis. No drastic effects were noted in the studies. (Katz-EIS)
W80-01321

EFFECTS OF PROLONGED EXPOSURE TO AMMONIA ON THE BLOOD AND LIVER GLYCOGEN OF COHO SALMON (ONCORHYNCUSH KISUTCH),
Municipality of Metropolitan Seattle, WA. Water Quality Lab.
J. A. Buckley, C. M. Whitmore, and B. D. Liming.
Comparative Biochemistry and Physiology, Vol 63C, p 297-303, 1979. 5 Tab, 59 Ref.

Descriptors: *Bioassay, *Toxicity, *Mortality, Nitrogen compounds, Water pollution effects, Laboratory tests, Salmon, *Coho salmon, Fish physiology, Biochemistry, Sewage effluents, Fish blood, Liver glycogen, *Ammonium compounds, Ammonium chloride, *Ammonia.

Duplicate groups (90 fish each) of hatchery-reared coho salmon were exposed for 91 days to either river water only (control), one of three concentrations of NH4C1 (3, 16, 47 mg N/1) in river water, or to 30% unchlorinated secondary-treated domestic sewage, all in continuous flow and unrecycled. Hemoglobin and hematocrit were reduced to levels indicative of anemia and the numbers of circulating immature erythrocytes increased. Mortalities were unrelated to concentrations of NH4C1. Blood ammonia and urea concentrations were not significantly different after 91 days regardless of concentration of ambient ammonia. Plasma Na+ concentration increased, probably as a result of accelerated NH4+ excretion; and in some instances plasma K+ and C1- concentrations changed. Blood glucose diminished, whereas liver glycogen stores increased; but these effects were significantly related only when glucose content was normal. (Katz-EIS)
W80-01322

ANALYSIS OF COMBINED EFFECT OF POLLUTANTS ON BIOLOGICAL SYSTEMS,
Moscow State Univ. (USSR).
V. N. Maksimov.
Hydrobiological Journal, Vol. 13, No. 4, p. 28-37, 1977. 3 fig, 5 tab, 6 ref.

Descriptors: *Water pollution effects, *Toxicity, Mortality, Bioassay, *Laboratory tests, *Methodology, Phytoplankton, Zooplankton, Analytical techniques, Zinc, Chromium, Oil, Oil spills, Dispersants, Mathematical studies, Desirability scale.

To elucidate the additivity or non-additivity of the effect of pollutants, specific interpretations of, data and their graphical representation are discussed. To unambiguously define the nature of the effect of one or more pollutants, we support an approach involving the derivation of a generalized index incorporating all the 'particular' responses of the elements of a system, i.e., a scale of desirability. Examples of analysis of experimental results by such a technique are given. Examples are given showing the effect of zinc and chromium salts on rotifer populations. Data are presented illustrating the effect of diesel oil, lubricating oil and one dispersant on phytoplankton species composition. Computations using these data derive the desirability scale. (Katz-EIS)
W80-01323

SURVEY OF GAMMA-EMITTING ARTIFICIAL RADIONUCLIDES IN FISH FROM FINNISH WATERS,
Abo Akademi, Turku (Finland). Inst. of Biology.
B. Isomaa, and J. Dahlbacka.
Aqua Fennica, Vol. 8, p 78-82, 1978. 2 Fig, 2 Tab, 11 Ref.

Descriptors: *Radioisotopes, *Cesium, *Fish physiology, *Radioecology, Path of pollutants, Radiochemical analysis, Potassium, Trophic level, Gamma rays, Freshwater fish.

The levels of artificial gamma-emitting radionuclides in fish from certain Finnish waters have been studied using a Be(Li)-spectrometer. The only artificial radionuclide found in detectable amounts in fish muscle was 137Cs. An inverse relationship between the potassium concentration in the water and the levels of 137Cs in the fishes was found. In fishes from the same water higher concentrations of 137Cs were found in predatory fishes than in fishes feeding on plankton and benthos. (Deal-EIS).
W80-01325

FOOD INTAKE, GROWTH, FOOD CONVERSION, AND BODY COMPOSITION OF CATFISH EXPOSED TO DIFFERENT SALINITIES,
Bangalore Univ. (India). Dept. of Zoology.
S. Arunachalam, and S. R. Reddy.
Aquaculture, Vol 16, p 163-171, 1979. 2 Fig, 4 Tab, 33 Ref.

Descriptors: *Salinity, *Catfishes, *Toxicity, Growth rates, Fish diets, Feeding rates, Fish physiology, Tubificids, Chemical analysis, Biomass, Productivity, Water chemistry, *Tissue Analysis.

The effects of different salinities (0, 2, 4, 6, and 10 o/oo) on food intake, growth, food conversion, and body composition of the freshwater catfish Mystus vittatus were studied. Under a restricted feeding schedule daily intake of food was found to be salinity dependent. Fish reared in 10 o/oo consumed more Tubifex tubifex, converted less efficiently and displayed poor growth as compared to individuals reared in fresh water. Fish flesh production decreased from 483 g (fresh water) to 177 g (10 o/oo salinity) as the salinity was increased. Water content of the fish was found to decrease with increase in salinity, while maximum ash (25.56%) and fat (42.25%) were exhibited by fish reared in 10 o/oo salinity. (Deal-EIS)
W80-01326

SEDATION OF WARM-WATER FISH SPECIES IN AQUACULTURE RESEARCH,
Stirling Univ. (Scotland) Unit of Aquatic Pathobiology.
L. T. Ross, and J. A. Geddes.
Aquaculture, Vol 16, p 183-186, 1979. 3 Tab, 2 Ref.

Descriptors: *Tilapia, *Toxicity, *Organic compounds, Fish physiology, Animal metabolism, Fish management, *Aquiculture, Respiration, Water temperature, Fry, *Benzocaine, *Anesthetics.

The technique of benzocaine sedation is outlined as a routine tool in aquaculture research. The effects of dose level and water temperature are demonstrated using 'Tilapia mariae'. Sensitivity to the agent varies according to species. Several general recommendations are made concerning the use of benzocaine for some species of tropical fish. (Deal-EIS)
W80-01327

THE EFFECTS OF TEMPERATURE ON THE RESPIRATION AND PRODUCTION OF THE FRESHWATER NEMATODE ANONCHUS SP.,
Lancaster Univ., Bailrigg (England). Dept. of Biological Sciences.
J. Laybourn.
Oecologia, Vol. 41, p. 329-337, 1979. 4 fig, 3 tab, 24 ref.

Descriptors: *Nematodes, *Growth rates, *Water temperature, Respiration, Animal metabolism, Animal physiology, Productivity, Oxygen requirements, Toxicity, Invertebrates, Weight, *Anonchus.

Growth and respiration were measured in a species of Anonchus at 5C, 10C, 15C, 20C and 25C. At 5C no growth was measurable but the organisms remained active. Maximum production occurred at 15C, but the highest rate of growth occured at 20C. Thus, adult size attained is dependent on the temperature of growth. Respiratory energy losses derived from Cartesian diver microrespirometry, increased with temperature up to 25C. Regression coefficients (b values) derived from a log linear regression of weight against oxygen consumption varied between 0.574-1.793, the lowest value being attained at 5C, the highest at 20C. Based on Q10, production and respiratory energy losses the optimum temperatures for Anonchus appears to lie between 10C-15C. (Deal-EIS)
W80-01328

PHYSIOLOGICAL BASIS OF DIFFERENTIAL SENSITIVITY OF FISH EMBRYONIC STAGES TO OIL POLLUTION,
Texas A and M Univ., College Station. Dept. of Biology.
J. R. Sharp, K. W. Fucik, and J. M. Neff.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 85-108, 1979. 9 Fig, 32 Ref.

Descriptors: *Oil, *Toxicity, *Killifishes, *Growth stages, Embryonic growth stage, Larval growth stage, Bioassay, Mode of action, Growth rates, Fish physiology, Animal metabolism, Mortality, *Naphthalenes, *Bioaccumulation.

The embryo-larval stages of the estuarine killifish Fundulus heteroclitus were moderately tolerant to the water-soluble fraction of a no. 2 fuel oil, showing an LC50 of approximately 1.5 ppm total hydrocarbons. The early embryonic stages were somewhat more sensitive to the 25% WSF than were later embryonic and larval stages. The heart beat rate of 9-11 day old embryos was significantly depressed only by WSF exposure regimes which also resulted in significant decreases in hatching success. Oxygen consumption of 10-day old embryos was slightly depressed by highly stressful exposure regimes and stimulated slightly by mildly stressful exposure regimes. Metabolic scope and energy reserves of fish embryos are small. When stressed by exposure to oil, limited metabolic energy is shunted away from critical differentiation and morphogenic processes to maintenance functions. The depressant effects of hydrocarbon stress early in development may be reflected in later embryonic stages by depressed development rate, hatching success and survival of emergent larvae and increased incidence of development anomalies. (Deal-EIS)
W80-01332

TOXIC CATIONS AND MARINE BIOTA: ANALYSIS OF RESEARCH EFFORT DURING THE THREE-YEAR PERIOD 1974-1976,
Environmental Research Lab., Narragansett, RI.

R. Eisler.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 111-149, 1979. 3 Tab, 1 Append, 236 Ref.

Descriptors: *Toxicity, *Aquatic life, *Cations, Heavy metals, Metals, Bioindicators, Methodology, *Zinc, *Mercury, *Copper, *Cadmium, *Lead, *Iron, *Manganese, Bioassay, Water pollution effects, Mollusks, Marine fish, Crustaceans, Marine algae, Marine animals, Annelids, Absorption, Path of pollutants, *Silver, *Arsenic.

Available technical articles published during 1974, 1975, and 1976 on effects of heavy metals and toxic cations upon estuarine and marine flora and fauna were reviewed. For all articles, research effort generated by toxicant, by response parameter, and by major indicator organism assemblage was tabulated for field investigations and for laboratory studies. Most of the effort during this period was restricted to 6 metals (Zn, Hg, Cu, Cd, Pb) and 4 indicator groups (molluscs, teleosts, crustaceans, algae). Laboratory investigators devoted a major portion of their workload to uptake, retention, and translocation studies, followed by studies on survival, on growth and development, reproduction, food chain transfer, behavior, respiration, body fluid chemistry, histology, and others, in that sequence. Results of field studies were confined almost exclusively to acquisition of data on baseline elemental composition and accompanying biotic and abiotic modifiers. Apparent limitations and deficiencies of current projects on biological effects assessment of metals and toxic cations in marine environments were presented and discussed. Suggestions were offered on direction and emphasis of future research in this subject area. (Deal-EIS)
W80-01333

THE USE OF BIVALVE MOLLUSCS IN HEAVY METAL POLLUTION RESEARCH,
North Carolina Central Univ., Durham. Dept. of Biology.
P. A. Cunningham.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 184-221, 1979. 1 Fig, 1 Tab, 103 Ref.

Descriptors: *Heavy metals, *Bioassay, *Mollusks, Bioindicators, Chemical properties, Absorption, Animal metabolism, Animal physiology, Path of pollutants, Growth stages, Animal behavior, Toxicity, Mortality, Mode of action, Analytical techniques, Reproduction, Water temperature, Salinity, Seasonal, Methodology, *Bioaccumulation, *Tissue analysis.

A summary of heavy metal research utilizing bivalve molluscs has been presented. In the past 5 years, use of new techniques has increased our understanding of the kinetics of metal uptake, tissue distribution, and release, but not all metals have been equally well studied. To further improve our understanding, genetically similar individuals with comparable histories need to be studied using the most sensitive analytical techniques available (i.e., electron microscopy coupled with microprobe analysis). Several areas in which knowledge of the toxicological effects of various metals could be expanded include: population effects, organism effects, organ and tissue effects and cellular and subcellular effects. Specific recommendations for further study are made in each of these research areas. (Deal-EIS)
W80-01336

A BENTHIC BIOASSAY USING TIME-LAPSE PHOTOGRAPHY TO MEASURE THE EFFECT OF TOXICANTS ON THE FEEDING BEHAVIOR OF LUGWORMS (POLYCHAETA: ARENICOLIDAE),
University of West Florida, Pensacola. Faculty of Biology.
N. I. Rubinstein.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 341-351, 1979. 4 Fig, 15 Ref.

Descriptors: *Pesticide toxicity, *Worms, *Bioassay, Benthic fauna, Food habits, Food chains, Animal behavior, Mode of action, Analytical techniques, Photography, Feeding rates, Insecticides, Chlorinated hydrocarbon pesticides, *Polychaetes, *Kepone, *Arenicola.

A benthic bioassay was developed to elucidate the effect of pollutants on the substrate reworking activity of an infaunal polychaete (Arenicola cristata). Lugworms exposed to the pesticide Kepone (at water concentrations as low as 2.8 microg/l) showed a significant reduction in sediment processing activity when compared with non-exposed animals. Reduction of substrate reworking activity by lugworms and other organisms with similar deposit feeding habits could affect sediment-water column dynamics and ultimately alter benthic food chains. Toxicity tests using sub-lethal responses to pollutants provide a sensitive and realistic way to evaluate the ecological impact of pollutants on the benthic component of the marine environment. (Deal-EIS)
W80-01341

DISTRIBUTION OF HYDROCARBONS AMONG OIL, WATER AND VAPOR PHASES DURING OIL DISPERSANT TOXICITY TESTS,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
A. Bobra, D. Mackay, and W. Y. Shiu.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 558-565, 1979. 2 Tab, 1 App, 8 Ref.

Descriptors: *Mathematical models, *Bioassays, *Oil spills, Toxicity, Oil, Chemical properties, Chemical reactions, Gases, Oil-water interfaces, Detergents, Organic compounds, Solubility, *Dispersants.

The problem is addressed of calculating the distribution of specific hydrocarbons between the oil phase (slick or dispersed), the aqueous phase and the vapor phase during a toxicity test. It is suggested that this calculation is an essential component of interpreting the toxicity observations since, in many cases, the exposure of the organism to hydrocarbons depends on the relative volumes of these three phases. A set of equations have been derived which permit the calculation of the partition of a hydrocarbon or group of hydrocarbons between oil, water and vapor phases. Their value in toxicity testing is discussed. (Deal-EIS)
W80-01346

SOURCE ASSESSMENT: PLASTICS PROCESSING, STATE OF THE ART,
Monsanto Research Corp., Dayton, OH.
T. W. Hughes, R. F. Boland, and G. M. Rinaldi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 926, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-78-004c, March 1978. 90 p, 18 Fig, 12 Tab, 61 Ref, 1 Append. 68-02-1874.

Descriptors: *Air pollution, *Plastics, *Industrial wastes, *Organic compounds, Water pollution sources, Industrial plants, Industrial production, Water pollution control, Water quality, Water quality standards, Industries, Pollutant identification.

The enivronmental impact of atmospheric emissions from plants that manufacture marketable products by means of plastics processing is evaluated, and the composition, quantity and rate of emissions for specific sources are reviewed. If no additional implementation of existing control technologies occurs, plastics processing will generate 54 percent greater mass emissions in 1981 than in 1976; these industries presently contribute 2.8 percent of national hydrocarbon emission and 0.12 percent of national particulate emissions. State-to-state ranges of these emissions are 0.04-8.96 percent for hydrocarbons and 0.00-2.59 percent for particulates. Secondary sources of information rather than new data were used for this state-of-art study. Included are: (1) An overiew of the industry, including process operations for 16 dinds of plastics, emission factors for different handling methods and operations, and source severities for criteria pollutants from 16 hypothetical but statistically typical plants representing each kind of plastic; (2) A description of raw materials and production processes, along with a geographic distribution of plant sites and plastic consumption; (3) An inventory of amounts and effects of uncontrolled atmospheric emissions from the 16 statistically typical processing plants; (4) A review of potentially appliable control technologyies; (5) An analysis of consumption trends which affect the future volume of plastic manufacturing. (Harris-Wisconsin)
W80-01372

SOURCE ASSESSMENT: RUBBER PROCESSING, STATE OF THE ART,
Monsanto Research Corp., Dayton, OH.
C. T. Chi, T. W. Hughes, T. E. Ctvrtnicek, D. A. Horn, and R. W. Serth.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 423, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-78-004j, March 1978. 118 p 18 Fig, 46 Tab, 39 Ref, 2 Append. 68-02-1874.

Descriptors: *Air pollution, *Rubber, *Industrial wastes, *Organic compounds, Synthetic rubber, Water pollution sources, Industrial production, Water pollution control, New Hampshire, Ohio, California, Water quality, Water quality standards, Industries, Pollutant identification.

The environmental impact of atmospheric emissions from rubber processing industries is assessed, and the composition, quantity and rate of emissions for specific sources are reviewed. Mass emissions from approximately 1,700 rubber processing plants in 43 states constitute 0.26 percent of national hydrocarbon emissions and 0.074 percent of national particulate emissions. About a fourth of these plants are located in Ohio and California and another fourth in Illinois, New York, New Jersey and Massachusetts. Only New Hampshire has emissions of at least one criteria pollutant from rubber processing which exceeds one percent of the state total emissions of that pollutants. Included are: (1) A detailed description of emission sources, comprising a general industry overview, a geography of rubber manufacturing plants, and an outline of industry production processes; (2) A discussion of specific kinds of emissions from processing plants; (3) An inventory of emission factors and associated environmental effects; (4) A description of present and future aspects of control technology; (5) Projectd industry growth and anticipated technological developments. Secondary sources of information (scientific literature and government data inventories) rather than new data were used for this state-of-the-art study. (Harris-Wisconsin)
W80-01373

OCEAN OUTFALL WASTEWATER DISPOSAL FEASIBILITY AND PLANNING.
North Carolina State Univ. at Raleigh, NC; and East Carolina Univ., Greenville, NC.; and North Carolina at Chapel Hill.
For primary bibliographic entry see Field 5E.
W80-01402

WATER QUALITY MONITORING DATA FOR GEORGIA STREAMS - 1977,
Georgia Dept. of Natural Resources, Atlanta. Environmental Protection Div.
January 1978. 315 p, 5 Fig, 113 Tab, 4 Ref.

Descriptors: *Measurement, *Stream gages, *Water measurement, *Streams, *Water quality, *Water analysis, *Baseline studies, *Monitoring, *River basins, *Georgia, Gaging stations, Streamflow, Freshwater, Pollutants, Sediment load, Biochemical oxygen demand, Chemical oxygen demand, Dissolved oxygen, Bioindicators. Coliforms, Runoff, Conductivity, Nutrient load, Diversity index.

This report compiles monitoring data for 113 sites across the State of Georgia for the year 1977. An

eight digit number was used to indicate the exact site of the stream monitoring gage, with the first two digits denoting one of the 15 major basins of the state being studied. These river systems are the Savannah, Ogeechee, Oconee, Upper Ocmulgee, Lower Ocmulgee, Altamaha, Satilla, St. Mary, Suwannee, Chloockee, Flint, Chattahoochee, Tallapoosa, Coosa, and Tennessee. Chemical analyses at monitoring points yielded minimum values for such agents as dissolved oxygen (DO), pH, nitrates and nitrites, light and heavy metals, biochemical oxygen demand (BOD), chemical oxygen demand (COD); and a determination of heavy and light metal and content of certain toxins in stream sediment. An organism 'diversity index' was compiled as part of the biological analysis of the streams, and various size filters and sieves were used to capture and categorize organisms. Categories established were macro-invertebrate organisms (though small enough to be capturable in a no. 30 mesh sieve), periphyton, plankton, and macrophyton. Stream quality was found to be generally quite high and toxic and sediment load low in the mountain streams of Northern Georgia and in the freshwater swamp streams of Southeastern Georgia, while tubridity, pollution and sediment loads were significantly higher in the more populous central part of the state. (Arnold-NC)
W80-01410

WATER QUALITY INVESTIGATION OF ESTUARIES OF GEORGIA - 1977,
Brunswick Junior Coll., GA.
Prepared for Georgia Department of Natural Resources, Environmental Protection Division, Atlanta, Annual Report, January 1978. 166 p, 5 Fig, 48 Tab, 37 Ref, 1 Append.

Descriptors: *Streams, *Measurement, *Stream gages, *Water measurement, *Estuaries, *Rivers, *Water quality, *Baseline studies, Water pollution, *Georgia, Gaging stations, Freshwater, Bioindicators, Fouling plates, Coliforms, Phosphates, Nutrients, Biochemical oxygen demand, Chemical oxygen demand, Dissolved oxygen.

This report compiles monitoring data from 11 stations in estuarine areas of the six coastal counties of the State of Georgia. Chemical, biological and physical analyses were conducted, and a 'diversity index' of biological organisms was compiled. Biological oxygen demand (BOD) was found to vary between 1.2 and 3.1 mg/l, a little higher than 1975 readings. Dissolved oxygen levels varied, but were found to correlate positively with existing chloride concentration, particularly at Brunswick Harbor. DO concentration averaged between 5.6 and 7.4 mg/l for the estuaries. Average color was found to have darkened since 1975, and average turbidity is increasing markedly in these waters. Phosphate load was found to be relatively low although fecal coliform counts were much greater than in 1976. Plexiglas 'fouling plates' were set out regularly at the 11 stations to collect samples of small stream organisms. The Altamaha and Ogeechee River areas had the lowest diversity of such organisms, in contrast to 1976, when they had nearly the greatest diversity. Average organism density and diversity were found to be much higher in summer than in winter. Dominant collected organisms were hydroids, barnacles, ectoprocts, and tube building amphipods.
W80-01411

ALGAL ASSAY AND CHEMICAL ANALYSIS: A COMPARATIVE STUDY OF WATER QUALITY ASSESSMENT TECHNIQUES IN A POLLUTED RIVER,
Illinois State Univ., Normal. Dept. of Biological Sciences.
J. R. Cain, R. L. Klotz, F. R. Trainor, and R. Costello.
Environmental Pollution, Vol 13, p 215-224, 1979. 1 Fig, 4 Tab, 17 Ref. OWRT A-052-CONN (20), 14-31-0001-3807.

Descriptors: *Water quality, *Water analysis, *Analytical techniques, Methodology baseline studies, Bioassay, Chemical analysis, Nutrients, Aquatic algae, Biomass, Growth rates, Water quality control, Phosphates, Nitrates.

The water quality of a polluted river was monitored for a two-year period by use of an algal bioassay and routine chemial analyses. Comparison of six sampling sites using t-tests for paired data for each parameter measured shows that the algal assay is as efficient as all chemical analyses in differentiating between sites. Comparison of the algal assay with each chemical parameter by means of correlation coefficients shows greatest correlation between the assay and orthophosphate. The benefits of using algal assays alone or in addition to chemical analyses are discussed. (Deal-EIS)
W80-01541

EFFECTS OF SOLAR RADIATION ON THE DYNAMICS OF DISSOLVED OXYGEN IN CHANNEL CATFISH PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
For primary bibliographic entry see Field 8I.
W80-01583

5B. Sources Of Pollution

ORIGIN AND VARIATION OF NITRATE NITROGEN IN THE CHALK SPRINGS, STREAMS, AND RIVERS IN DORSET AND ITS UTILIZATION BY HIGHER PLANTS,
Freshwater Biological Association, Wareham (England), River Lab.
For primary bibliographic entry see Field 5C.
W80-01276

MICROBIOLOGICAL STUDIES ON THE QUALITY OF URBAN STORMWATER RUNOFF IN SOUTHERN ONTARIO, CANADA,
Ontario Ministry of the Environment, Rexdale (Ontario). Lab. Services Branch.
For primary bibliographic entry see Field 5A.
W80-01283

A SQUARE GRID TRANSPORT MODEL RELATING LAND USE EXPORTS TO NUTRIENT LOADS IN RIVERS,
Institute National de la Recherche Scientifique, Rimouski (Quebec).
D. A. Cluis, D. Couillard, and L. Potvin.
Water Resources Research, Vol 15, No 3, p 630-636, June 1979. 3 Fig, 5 Tab, 12 Ref.

Descriptors: *Water quality, *Rivers, *Land use, *Model studies, *Canada, Watersheds(Basins), Analysis, Analytical techniques, Nutrients, Mathematical models, Nitrogen, Phosphorus, Water pollution sources, Agricultural runoff, *Yamaska River, Nutrient transport model, Stream loading, Nonpoint pollution sources.

This transport model relates a nutrient-oriented land use data bank to mass discharges of total nitrogen and total phosphorus on an annual or seasonal basis. This bank is based upon already available Canadian statistics distributed upon drainage units of the Universal Transverse Mercator square grid system; it contains information on the intensities and spatial distributions of the produced loads for both types of sources (direct and diffuse). Using two constants only, the contribution of a drainage unit to a downstream site can be written as L = (C sub T to the K power) (P + (C b I x NP)), where P and NP represent the point and nonpoint production of nutrients; C sub I is an internal transfer coefficient of nonpoint sources to the river; C sub T is a transport coefficient from one unit to the following unit; and K is a distance expressed in number of units covered. Stable sets of coefficients were obtained for each season, reflecting the hydrological regime and differences in mobility of phosphorus and nitrogen. Once it is calibrated, the model can be used to assess the relative contributions of each type of land use and to predict the effect of impoundments or changes in land use. (Humphreys-ISWS)
W80-01286

AN INVESTIGATION OF THE HEAVY METAL CONTENT OF THE WATER AND SEDIMENTS IN A RESERVOIR SUPPLYING DRINKING WATER TO A MAJOR MINING CENTER,
W. S. and L. B. Robinson Univ. Coll., Broken Hill (Australia).
For primary bibliographic entry see Field 5A.
W80-01292

NOTES ON MUDDY ODOUR. II UPTAKE OF 2-METHLISOBORNEOL BY RAINBOW TROUT (SALMO GAIRDNERI) IN CONTINUOUS FLOW AQUARIA,
Helsinki Univ. (Finland). Dept. of Limnology.
For primary bibliographic entry see Field 5A.
W80-01317

POLYCHLORINATED BIPHENYLS (PCB'S) IN PUGET SOUND: PHYSICAL/CHEMICAL ASPECTS AND BIOLOGICAL CONSEQUENCES,
Washington Univ., Seattle.
For primary bibliographic entry see Field 5A.
W80-01318

DETOXIFICATION SYSTEM IN POLYCHAETE WORMS: IMPORTANCE IN THE DEGRADATION OF SEDIMENT HYDROCARBONS,
Skidway Inst. of Oceanography, Savannah, GA.
R. F. Lee, S. C. Singer, K. R. Tenore, W. S. Gardner, and R. M. Philpot.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 23-37, 1979. 5 Fig, 2 Tab, 34 Ref.

Descriptors: *Invertebrates, *Oil, *Animal metabolism, Enzymes, Biochemistry, Chemical reactions, Biodegradation, Genetics, Adaptation, Organic compounds, Microbial degradation, Bottom sediments, Benthic fauna, *Polychaetes, *Nereis, *Capitella.

The polychaetes, Nereis virens and Capitella capitata, have a mixed function oxygenase (MFO) system which metabolizes polycyclic aromatic hydrocarbons. In Nereis virens this enzyme system was associated with microsomes of the lower intestine. Similarities between the MFO of polychaetes and other animals, both vertebrate and invertebrate, were noted with respect to cytochrome P-450 and phospholipid components, cofactor requirements, effect of inhibitors, pH optima and temperature optima. MFO activity was found in Capitella capitata only after exposure to either petroleum or its components with worms, primarily of the third generation, having higher MFO activity than the first or second generation of worms exposed to petroleum. Selection of a genotype with increased MFO activity was suggested. Polychaetes were important in degradation of crude oil both by directly degrading hydrocarbons and indirectly by turning over sediments during feeding, thus allowing petroleum-degrading microbes to metabolize subsurface hydrocarbons. (Deal-EIS)
W80-01330

CONDITION INDEX AND FREE AMINO ACID CONTENT OF MACOMA INQUINATA EXPOSED TO OIL-CONTAMINATED MARINE SEDIMENTS,
Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
G. Roesijadi, and J. W. Anderson.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vanberg, Eds., Academic Press, New York, p 69-83, 1979. 1 Fig, 5 Tab, 28 Ref.

Descriptors: *Clams, *Oil, *Toxicity, Amino acids, Biochemistry, Path of pollutants, Bottom sediments, Oil pollution, Bioindicators, Chemical analysis, Mode of action, Mortality, Animal behavior, Animal metabolism, *Macoma, *Tissue analysis.

Stress in Macoma inquinata exposed to oil-contaminated sediment was evident at 3 levels of examination. These were reduced survival, reduced condition index, and reduced levels of free amino acids, primarily glycine, with concomitant eleva-

tions in the taurine:glycine ratio. This study has provided evidence that free amino acid content, as well as condition index, may be useful indicators of physiological stress in marine bivalves exposed to petroleum. These parameters may also be useful as general indicators of pollutant stress in bivalves and, possibly, other marine organisms. (Deal-EIS)
W80-01331

TOXIC CATIONS AND MARINE BIOTA: ANALYSIS OF RESEARCH EFFORT DURING THE THREE-YEAR PERIOD 1974-1976,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W80-01333

HEMATOLOGICAL EFFECTS OF LONG-TERM MERCURY EXPOSURE AND SUBSEQUENT PERIODS OF RECOVERY ON THE WINTER FLOUNDER, PSEUDOPLEURONECTES AMERICANUS,
National Marine Fisheries Service, Milford, CT. Northeast Fisheries Center.
M. A. Dawson.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 171-182, 1979. 2 Tab, 21 Ref.

Descriptors: *Mercury, *Toxicity, *Fish physiology, Biochemistry, Heavy metals, Proteins, Calcium, Sodium, Potassium, Animal metabolism, Bioassay, Mode of action, Chlorides, *Flounder, *Pseudopleuronectes, *Hematology, *Tissue analysis, *Hemoglobin.

Winter flounder were exposed to 10- and 20-ppb mercury as the chloride for 60 days and subsequently allowed to recover for 15 or 60 days in clean seawater in order to determine mercury effects and the rate and extent of recovery as measured by a variety of hematological tests. Following the 60-day exposure period, the hemoglobin, hematocrit, erythrocyte count (RBC), and mean corpuscular hemoglobin count (MCHC) decreased in exposed fish. Mean corpuscular volume (MCV) increased in exposed animals. The 15-day recovery period brought about virtually no recovery of the red-cell component of the blood. After the 60-day recovery period, animals exposed to 20-ppb mercury returned to the control levels in hemoglobin and RBC; MCV remained at its previous elevated level. Fish exposed to 10-ppb mercury returned to control levels in all these variables. Plasma sodium concentration rose in both exposure groups following the 15-day recovery period. After the 60-day recovery, the values were highly variable and not significantly different from controls. Plasma calcium concentrations dropped in exposed fish, returning to control values after 15 days of recovery. (Deal-EIS)
W80-01335

PRELIMINARY OBSERVATIONS ON THE CYTOPATHOLOGICAL EFFECTS OF COPPER SULFATE ON THE CHEMORECEPTORS OF CALLINECTES SAPIDUS,
National Marine Fisheries Service, Oxford, MD. Northeast Fisheries Center.
J. E. Bodammer.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 223-237, 1979. 9 Fig, 24 Ref.

Descriptors: *Toxicity, *Crabs, *Copper sulfate, Cytological studies, Animal pathology, Animal physiology, Mode of action, Crustaceans, Heavy metals, Sulfates, Copper, Copper compounds, *Tissue analysis.

The present investigation indicates that copper may have a necrotizing effect on the dendrites of blue crab chemoreceptors. At 1000 microg/l, copper sulfate solutions completely disrupt the integrity and disposition of the dendrites within all the sensilla that were examined. In this instance, the damage sustained by the receptor cells is extensive and suggests that they are probably nonfunctional. It is not known at the present time whether the observed lesions resulted directly from an interaction between the toxicant and receptor cell processes, or whether they occurred as a result of otheralterations in homeostasis. At lesser concentrations (100 and 50 microg/l) the effects of copper sulfate on the receptor cell dendrites are less intense and variable between aesthetascs in the 100 microg/l group, while the vast majority of sensilla from the 50 microg/l test appear 'normal'. (Deal-EIS)
W80-01337

COPPER AND CADMIUM INDUCED CHANGES IN THE METABOLISM AND STRUCTURE OF MOLLUSCAN GILL TISSUE,
National Marine Fisheries Service, Beaufort, NC. Southeast Fisheries Center.
D. W. Engel, and B. A. Fowler.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 239-256, 1979. 9 Fig, 26 Ref.

Descriptors: *Copper, *Cadmium, *Toxicity, *Oysters, Animal physiology, Animal metabolism, Heavy metals, Mode of action, Oxygen requirements, Biochemistry, Proteins, Chemical analysis, Electron microscopy, Mollusks, Path of pollutants, Respiration, *Bioaccumulation, *Tissue analysis, *Crassostrea, *Gills.

Experiments were conducted to determine the physiological and cellular effects of accumulated copper and cadmium on the gill tissue of Eastern oyster, Crassostrea virginica, as a measure of damage to the whole animal. The oysters were exposed to either 50 or 100 ppb copper, or 100 or 600 ppb cadmium continuously for up to 14 days. The gill tissue from exposed oysters accumulated both copper and cadmium as a function of time of exposure. Copper caused significant increases in the rate of oxygen consumption only in the 100 ppb exposure group and 600 ppb cadmium also caused similar changes, but the data were more variable. Comparisons of the fine structures of gill tissue from oysters exposed to either 100 ppb copper or 100 ppb cadmium for 14 days showed that only copper caused intracellular alterations. Exposure to 100 ppb cadmium, however, caused the induction of a cadmium-binding, low-molcular weight protein. (Deal-EIS)
W80-01338

FATTY ACID COMPOSITION OF PHOSPHOLIPIDS IN THERMALLY ACCLIMATING SCULPINS (LEPTOCOTTUS ARMATUS) TREATED WITH POLYCHOLRINATED BIPHENYLS (AROCLOR 1254),
Oregon State Univ., Newport. Dept. of Fisheries and Wildlife.
R. S. Caldwell, E. M. Caldarone, and B. A. Rosene.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 271-290, 1979. 4 Fig, 1 Tab, 31 Ref.

Descriptors: *Aroclors, *Toxicity, *Lipids, Polychlorinated biphenyls, Water temperature, Mode of action, Adaptation, Biochemistry, Animal metabolism, Fish physiology, Chemical analysis, Organic acids, *Leptocottus, *Sculpins, *Tissue analysis.

Treatment of juvenile sculpins (Leptocottus armatus) with a sublethal dose of the polychlorinated biphenyls (PCB's) mixture, Aroclor 1254, resulted in a modification of the pattern of fatty acids in whole body phospholipids during 12 days of acclimation to either 7 or 19.2 C compared to ethanol injected controls. At both acclimation temperatures, the phospholipids of the PCB treated fish, compared to controls, contained more saturated fatty acids and the magnitude of the change in saturation level at both temperatures was comparable to the differences seen between cold (7 C) and warm (20 C) acclimated fish not treated with PCB's. Based on the observed effects due to PCB treatment in this study and the observed and known adaptive responses of fatty acid composition associated with temperature acclimation of poikilotherms, it is suggested that the Aroclor treated fish may be functionally adapted to a temperature approximately 13 C higher than their acclimation temperature. The observed effects on the fatty acid composition of the phospholipids of PCB treated fish is interpreted in the context of effects of the pollutant on the microsomal fatty acid desaturating system of vertebrates. (Deal-EIS)
W80-01339

PHYSIOLOGICAL AND BIOCHEMICAL INVESTIGATIONS OF THE TOXICITY OF PENTACHLOROPHENOL TO CRUSTACEANS,
University of West Florida, Pensacola. Faculty of Biology.
K. R. Rao, F. R. Fox, P. J. Conklin, A. C. Cantelmo, and A. C. Brannon.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 307-339, 1979. 16 Fig, 1 Tab, 66 Ref.

Descriptors: *Pesticide toxicity, *Crustaceans, *Growth stages, Shrimp, Crabs, Sodium compounds, Mode of action, Mortality, Animal physiology, Animal metabolism, Biochemistry, Enzymes, Inhibition, Bioassay, Larval growth stage, Chemical properties, Proteins, Carbohydrates, Lipids, *Pentachlorophenol(PCP), *2-4-dinitrophenol(DNP), *Tissue analysis.

The toxicity of sodium pentachlorophenate (Na-PCP) to the grass shrimp, Palaemonetes pugio, varied with the stage in the molt cycle. In both short-term (96 hr bioassay) and long-term (66 days) studies newly molted shrimp exhibited the greatest sensitivity to Na-PCP. Crustaceans are capable of regenerating lost limbs. The effects of Na-PCP on oxygen consumption varied depending on the stage of the molt cycle and the concentration of Na-PCP. Tests on isolated tissues (muscle, gill and hepatopancreas) from the blue crab, Callinectes sapidu, revealed that Na-PCP and 2,4-dinitrophenol (DNP) inhibit oxygen consumption in vitro. Na-PCP and DNP had inhibitory effects on several hepatopancreatic enzymes in blue crabs. The present studies on crustaceans and the previous studies on fish, molluscs and rats seem to indicate that PCP affects carbohydrate metabolism, lipid metabolism, ion transport and possibly protein metabolism. The inhibitory effects on a wide variety of enzymes suggest that the actions may be due to non-specific interactions of this phenol with membrane proteins. (Deal-EIS)
W80-01340

BEYOND THE LC50: AN OPINION ABOUT RESEARCH ACTIVITIES AND NEEDS CONCERNING PHYSIOLOGICAL EFFECTS OF POLLUTANTS IN THE ENVIRONMENT,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
C. J. Sindermann.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 437-450, 1979. 19 Ref.

Descriptors: *Bioassay, *Analytical techniques, *Monitoring, Methodology, Animal physiology, Mode of action, Laboratory tests, Organic compounds, Heavy metals, Oil, Water pollution effects, Animal metabolism, Biochemistry, Toxicity.

Physiological studies of pollutants in the coastal/estuarine environment--heavy metals, petroleum components, and halogenated hydrocarbons--have provided much information about effects on the biota. Data from laboratory experiments; combined with field observations and results of field experiments, reduce intuitive conclusions and expand areas of genuine understanding. There is still, however, a large area of uncertainty about multiple pollutant effects on marine organisms, and the critical problem of resistance to contaminant toxicity is only now beginning to be elucidated. A satisfying shift of emphasis toward understanding sublethal effects of long-term exposure to contaminants and away from artificial short-term acute exposures has taken place. Additionally, greater attention has been focused on metabolic pathways,

induction of resistance mechanisms, and possibilities for monitoring using physiological/biochemical criteria. (Deal-EIS)
W80-01345

DISTRIBUTION OF HYDROCARBONS AMONG OIL, WATER AND VAPOR PHASES DURING OIL DISPERSANT TOXICITY TESTS,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
For primary bibliographic entry see Field 5A.
W80-01346

POLLUTANS LOADINGS IN URBAN STORM WATER,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
P. V. Roberts, L. Dauber, B. Novak, and J. Zobrist.
Progress in Water Technology, Vol 8, No 6 p 93-101, 1977. 2 Fig, 3 Tab, 13 Ref.

Descriptors: *Urban runoff, *Storm runoff, *Water pollution control, *Surface runoff, *Sewage treatment, *Separated sewers, Storm water, Pollutants, Sewage, Sewage effluents, Switzerland, Waste water disposal, Combined sewers, Sewage disposal, Water pollution treatment, Sewerage, Wate pollution sources.

One solution to pollution caused by combined runoff and sanitary sewage systems is to divert relatively unpolluted storm water from sanitary sewer systems and discharge it without treatment. Storm water pollutant in a section of Zurich, Switzerland, is equivalent to secondary effluent, except for high concentrations of suspended solids, and these are relatively inorganic compared to sewerage solids and do not contain large amounts of pollutants. Several advantages to separate systems are noted: reduced treatment plant disturbances from hydraulic shock loads; higher wastewater temperatures in wnter; and reduced pollutional load in combined sewer overflows. These tnetative conclusions were made after six months of measuring pollutant load in runoff from a well-defined residential area with complete separation of storm and sanitary sewer systems. The study area had light traffic, regular street cleaning, flat topography, and 100 people/hectare. The 1975 study recorded 409 mm precipitation totaling 12,200 cu m of runoff with 70% of the volume sufficient for water sample chemical analyses. Annual per-capital load was greater for biologically treated municipal sewage effluent than storm water for all pollutants. Most countries combine runoff and sanitary sewage. The plants normally treat twice the peak dry weather flow and allow the excess to overflow during wet weather. This seriously contributes to water pollution. (Danovich-Wisconsin)
W80-01364

GROWTH RESPONSE OF ANABAENA FLOS-AQUAE (LYNGB.) DEBREBISSON IN WATERS COLLECTED FROM LONG LAE RESERVOIR, WASHINGTON,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 5C.
W80-01369

USE OF ALGAL ASSAYS TO ASSESS THE EFFECTS OF MUNICIPAL AND SMELTER WASTES UPON PHYTOPLANKTON PRODUCTION,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 5C.
W80-01370

SOURCE ASSESSMENT: PLASTICS PROCESSING, STATE OF THE ART,
Monsanto Research Corp., Dayton, OH.
For primary bibliographic entry see Field 5A.
W80-01372

SOURCE ASSESSMENT: RUBBER PROCESSING, STATE OF THE ART,
Monsanto Research Corp., Dayton, OH.
For primary bibliographic entry see Field 5A.
W80-01373

WATER QUALITY OF AQUIFERS AS AFFECTD BY MOVEMENT OF FERTILIZER NUTRIENTS UNDER IRRIGATION,
Minnesota Univ., St. Paul. Dept. of Soil Science.
A. C. Caldwell, and G. C. Buzicky.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116585, Price codes: A02 in paper copy, A01 in microfiche. Report Water Resources Research Center, University of Minnesota 1979. 9 p. OWRT A-034-MINN (2).

Descriptors: *Aquifers, *Irrigation, *Nutrients, *Fertilizers, Sulfur, Path pollutants.

A field experiment was established on a Sverdrup sandy loam in Central Minnesota to evaluate the effects of amounts and timing of nitrogen (N) fertilizer applications on N uptake by irrigated corn (Zea mays L), and the movement of N into the aquifer 4.5 m below the soil surface. Nitrogen was applied as urea at rates of 179 and 269 kg N/ha in one application at planting or in split applications through the season. (Blake-Minn)
W80-01376

HYDROLOGIC DATA FOR A SUBSURFACE WASTE-INJECTION SITE AT MULBERRY, FLORIDA, 1972-77,
Geological Survey, Tallahassee, FL. Water Resources Div.
W. E. Wilson, D. C. Parsons, and R. M. Spechler.
Geological Survey open-file report 79-683, 1979. 33 p, 4 Fig, 5 Tab, 3 Ref.

Descriptors: *Industrial wastes, *Waste disposal wells, *Injection wells, *Path of pollutants, *Chemical analyses, Liquid wastes, Water analysis, Observation wells, Aquifer characteristics, Dolomite, Limestones, Florida, Water levels, Hydrologic data, Hydrographs, *Mulberry(FL).

Since October 1972, industrial liquid waste has been injected into a brine aquifer of limestone and dolomite in Mulberry, FL., at a depth of more than 4,000 feet below land surface. During 1977, the injection rate was about 8.8 million gallons per month. To determine what effect the injected waste has on the ground-water body, water levels have been measured and water samples collected from two monitor wells that tap different permeable zones above the injection zone, and from a satellite monitor well that taps the injection zone. The monitor wells are in the annulus of the injection well, and the satellite monitor well is 2,291 feet from the injection well. This report updates previous data reports and includes all hydrologic data collected by the U.S. Geological Survey during 1972-77. Included is a table of well-construction data, a graph showing the volume of waste injected each month, and hydrographs of the annulus monitor wells and the satellite monitor well. (Woodard-USGS)
W80-01418

SEDIMENTS OF LAKE ROTORUA AS SOURCES AND SINKS FOR PLANT NUTRIENTS,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
For primary bibliographic entry see Field 5C.
W80-01441

LAKES AND PHOSPHORUS INPUTS, A FOCUS ON MANAGEMENT,
New York State Coll. of Agriculture and Life Sciences, Ithaca.
For primary bibliographic entry see Field 5G.
W80-01465

VOLATILE ORGANIC COMPOUNDS IN SEAWATER,
Woods Hole Oceanographic Institution, MA. Dept. of Chemistry.
P. M. Gschwend.
Doctoral Dissertation, Woods Hole Oceanographic Institution Technical Report No. WHOI-79-72, August 1979. 272 p, 45 Fig, 13 Tab, 166 Ref, 5 Append.

Descriptors: *Organic compounds, *Sea water, *Water pollution sources, *Oil pollution, Spatial distribution, Temporal distribution, Volatility, *Biogenic sources, *Anthropogenic sources, Benzenes, Naphthalenes, Hydrocarbons, Pentadecane, Heptadecane, Sea Grant Program.

Vapor phase stripping and solid adsorbent trapping were applied to seawater and related samples to concentrate volatile organic compounds. The concentrates were subsequently analyzed by glass capillary gas chromatography and combined gas chromatography-mass spectrometry. The compound identities and the spatial and temporal distributions of their concentrations were used to determine some sources, transformations and transport mechanisms of organic matter in the sea. Volatile organic compounds were determined in seawater samples from the Sargasso Sea, the western Equatorial Atlantic, and the upwelling region off Peru. Pentadecane was present in all three areas in surface samples. The temporal variations of volatile organic compound concentrations were investigated in coastal seawater from Vineyard Sound, Massachusetts. Pentadecane and heptadecane showed large summertime concentrations increases which were ascribed to benthic algal sources. Laboratory incubations of benthic algal samples supported this conclusion. (NOAA)
W80-01539

POLLUTION CHARACTERISTICS IN AN UNPOLLUTED SUBARCTIC STREAM,
Alaska Univ., Fairbanks. Dept. of Environmental Health Sciences.
L. A. Peterson.
The Northern Engineer, Vol 10, No 1, p 15-17, Spring 1978. 2 Fig, 5 Ref, 4 Photo. OWRT-B-017-ALAS(7).

Descriptors: *Water pollution, *Water pollution sources, *Alaska, *On-site investigations, Subarctic, Streams, Groundwater, Cold regions, Dissolved oxygen, Hydrogen ion concentration, Sediments, Water properties, Water quality, Carbon dioxide, Iron, *Goldstream Creek(AK).

Goldstream Creek, a small subarctic stream, drains a region of increasing domestic development northwest of Fairbanks, Alaska. Observed variations in water quality occurred between the Ballaine Bridge (BB) and Sheep Creek Road Bridge (SCRB) sampling sites which drain 73.7 sq mi and 93.3 sq mi, respectively. A large bog area exists above the SCRB site north of the stream, and a smaller bog area lies above the BB site. Dissolved oxygen was essentially depleted (0.3 mg/l); ammonia-nitrogen, nitrate-nitrogen, and specific conductance values were abnormally high; and pH was below normal. These and other anomalies were observed during the winter of 1970-71. The source of pollution proved to be not human activity but a natural phenomenon. Groundwater seeping through organic silt deposits into the stream was responsible for the 'polluted' condition. The importance of this is that water quality standards are being implemented which, in a few cases, are higher than the natural quality. (Humphreys-ISWS)
W80-01545

TRANSBOUNDARY GROUND WATER POLLUTION: SURVEY AND TRENDS IN TREATY LAW,
Fordham Univ., Bronx, NY. School of Law.
For primary bibliographic entry see Field 6E.
W80-01546

MAGNITUDES, NATURE, AND EFFECTS OF POINT AND NONPOINT DISCHARGES IN THE CHATTAHOOCHEE RIVER BASIN, ATLANTA TO WEST POINT DAM, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.

J. K. Stamer, R. N. Cherry, R. E. Faye, and R. L. Klechner.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.00, Geological Survey Water-Supply Paper 2059, 1979. 65 p, 27 Fig, 22 Tab, 35 Ref.

Descriptors: *Water pollution sources, *Inflow, *Streams, *Water analysis, *Water pollution control, Streamflow, Flow rates, Data collections, Chemical analysis, Dissolved solids, Biochemical oxygen demand, Nitrification, Algae, Regulated flow, Urbanization, Powerplants, Thermal pollution, Waste water treatment, Georgia, *Chattahoochee River(GA), *West Point Lake(GA), Point-source discharge, Nonpoint-source discharge.

On an average annual basis and during the storm period of March 12-15, 1976, nonpoint-source loads for most constituents were larger than point-source loads at the Whitesburg station, located on the Chattachoochee River about 40 miles downstream from Atlanta, Ga. Most of the nonpoint-source constituent loads in the Atlanta to Whitesburg reach were from urban areas. Average annual point-source discharges accounted for about 50 percent of the dissolved nitrogen, total nitrogen, and total phosphorus loads and about 70 percent of the dissolved phosphorus loads at Whitesburg. During a low-flow period, June 1-2, 1977, five municipal point-sources contributed 63 percent of the ultimate biochemical oxygen demand, and 97 percent of ammonium nitrogen loads at the Franklin station, at the upstream end of West Point Lake. Dissolved-oxygen concentrations of 4.1 to 5.0 milligrams per liter occurred in a 22-mile reach of the river downstream from Atlanta due about equally to nitrogenous and carbonaceous oxygen demands. The heat load from two thermoelectric powerplants caused a decrease in dissolved-oxygen concentration of about 0.2 milligrams per liter. Phytoplankton concentrations in West Point Lake, about 70 miles downstream from Atlanta, could exceed three million cells per milliliter during extended low-flow periods in the summer with present point-source phosphorus loads. (Woodard-USGS)
W80-01590

SALTWATER ENCROACHMENT IN THE '600-FOOT' AND '1,500-FOOT' SANDS OF THE BATON ROUGE AREA, LOUISIANA, 1966-78, INCLUDING A DISCUSSION OF SALTWATER IN OTHER SANDS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
C. D. Whiteman, Jr.
Louisiana Department of Public Works Water Resources Technical Report No 19, 1977. 49 p, 11 Fig, 7 Plates, 3 Tab, 12 Ref.

Descriptors: *Saline water intrusion, *Groundwater, *Aquifer characteristics, *Saline water-freshwater interfaces, Aquifer management, Planning, Injection wells, Artificial recharge, Data collections, Water wells, Pumping, Water supply, Water quality, Projections, Groundwater movement, Water levels, Louisiana, *Baton Rouge area(LA).

Saltwater encroachment has been observed in the '600-foot', '2,000-foot,' and '2,800-foot' sands of the Baton Rouge area, La. The encroachment is the result of leakage of salty water across the Baton Rouge fault in response to pumpage north of the fault. Salty water in the '1,500-foot' sand may reach the Government Street well field in about 30 years, and a control strategy should be adopted and placed in operation as soon as possible to minimize contamination of the aquifer and damage to existing well fields. Encroachment in the '600-foot' sand may not produce serious problems for about 40 years, but the ultimate effects of encroachment in the '600-foot' sand may be more damaging than encroachment in the '1,500-foot' sand. If control measures are to be instituted for the '600-foot' sand, for maximum effectiveness, they should begin as soon as practical to do so and within about 20 years at the latest. Control measures in the other sands in which encroachment is indicated can probably be delayed longer if adequate monitoring is maintained. Of several possible control stragegies, the most practical will probably consist of discharge wells pumping salty water from the aquifers near the fault. Injection wells to dispose of the salty water will probably also be needed. (Woodard-USGS)
W80-01594

5C. Effects Of Pollution

PUBLIC INFORMATION AND LAKE EUTROPHICATION: A CASE STUDY OF GULL LAKE IN SOUTHWESTERN MICHIGAN,
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
G. H. Lauff, B. Moss, and D. F. Tague.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-113715, Price codes: A04 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, Project Completion Report November, 1979. 72 p, 4 Fig, 15 Tab, 48 Ref. OWRT B-021-MICH (2), B-032-MICH (2), 14-21-0001-3599 and 14-31-0001-4.

Descriptors: *Lakes, *Phosphorus, *Fertilizers, *Spetic tanks, *Eutrophication, *Oxygen demand, *Gull Lake(MI), *Lawn fertilizers.

Since 1965 Gull Lake's water quality has rapidly deteriorated. The principal cause of its decline is phosphorus enrichment from septic systems and over-fertilized lawns. Efforts have been directed toward obtaining a reduction in phosphorus input through a community education and action program. A monitoring program has provided extensive baseline data. Dissemination of evidence documenting Gull Lake's degradation has helped motivate the citizenry to undertake corrective measures. Algal increases and changes, and the rate and extent of hypolimnetic oxygen depletion have been particularly useful toward this end. Total oxygen depletion in the lower-most water of Gull Lake was first recorded in 1966. The maximum development of oxygen depletion was recorded in the summer of 1972. The rate of oxygen depletion is directly related to the level of algal growth. To control phosphorus input from domestic sources, sewage must eventually be diverted from Gull Lake. In addition, the use of lawn fertilizers containing phosphorus must be eliminated on property adjacent to the lake. Evidence does point to the willingness of Gull Lake residents to accept life style changes resulting in reduction of nutrient input but these are likely inadequate to stabilize or reverse eutrophication trends. The lake community has worked closely with the townships and counties involved to initiate a sanitary sewer to service Gull Lake - grant decisions are pending.
W80-01255

EFFECTS OF AMMONIA ENRICHMENT AND HIGH LIGHT INTENSITY ON A SALT MARSH DIATOM COMMUNITY,
Mississippi State Univ., Mississippi State.
M. J. Sullivan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-113483, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute Mississippi State University Report, 1979. 53 p, 1 Fig, 12 Tab, 27 Ref. OWRT A-124-MISS (1), 14-34-0001-9026.

Descriptors: *Water pollution effects, *Diatoms, *Nitrogen, *Light intensity, *Salt marshes, Nutrients, Soil algae, Eutrophication, Bioindicators, Biological communities, Mississippi, Water quality, Ammonia, Light intensity, *Taxa, *Community structure, *Graveline Bay Marsh(MS), Distichlis, Nitzschia.

Edaphic diatoms were collected seasonally from a monotypic stand of Distichlis spicata on a Mississippi salt marsh, in which the marsh surface had been exposed to high light intensity by clipping the grass shoots and enriched with NH4Cl. Clipping greatly reduced species diversity (H') and the number of taxa in a sample (S) in all seasons except winter, but did not stimulate the growth of filamentous algae. Nitrogen enrichment increased H' and S in spring. Of the 111 taxa encountered, clipping eliminated 9 preexisting taxa and introduced 3 new taxa into the community. No such effect was induced by nitrogen enrichment. A 3-way ANOVA (light x nitrogen x date) of the relative abundances of the 16 most abundant taxa revealed that 11 taxa were characterized by a significant 3-way interaction term. As with community diversity, effects due to clipping were more prevalent than those due to nitrogen enrichment. However, two taxa -Nitzschia perversa and N. gandersheimiensis, may represent bioindicator organisms for detecting nitrogen enrichment in Gulf Coast salt marshes. Nitrogen enrichment greatly stimulated the aerial yield of control D. spicata stands and the regrowth of those clipped 3 months earlier. Thus, the D. spicata- edaphic diatom complex showed pronounced responses to the treatments employed and appears to have a capacity for assimilating exogenously added nitrogen.
W80-01258

ORIGIN AND VARIATION OF NITRATE NITROGEN IN THE CHALK SPRINGS, STREAMS, AND RIVERS IN DORSET AND ITS UTILIZATION BY HIGHER PLANTS,
Freshwater Biological Association, Wareham (England), River Lab.
Progress in Water Technology, Vol 8, No 4-5, p 225-235, 1977. 6 Fig, Tab, 28 Ref.

Descriptors: *Dorset(England), *Nitrates, *Macrophytes, *Water pollution sources, *Nutrient budgets, *Nitrogen, Rivers, Streams, Springs, Boreholes, Frome River(England), Piddle River(England), Hydrogeology, Ranunculus penicillatus var. calcareus, Rorippa nasturtium aquaticum, Watercress, Rainfall, Sewage disposal, Effluents, Chalk, England.

Nitrate concentrations in chalk streams and boreholes in Dorset were fairly constant 1968-73, whereas in similar sites elsewhere in England there were large increases, possibly due to differences in farming practices or geology. In the major river of the Dorset study area, the River Frome, mean nitrate concentration increased 1965-72, which cannot be accounted by sewage effluent increases of 29% over the period, and rainfall at most could have contributed 28.9% of total nitrate throughout; the increase must therefore be due to increased fertilizer use, growth of more legume crops, or more nitrogen imported as livestock food. Utilization of the nitrate-nitrogen by the higher plants Ranunculus penicillatus var. calcareus and Rorippa nasturtium (watercress) was low, about 2% of the throughput. Samples of rainfall and water from the boreholes, springs, streams, and main river were analyzed to determine nitrate-nitrogen sources in the system, and the range and variation of nitrate values at times of increased flow. The River Frome and River Piddle systems lie in a shallow chalk basin overlying lower Cretaceous strata. In much of the basin areas the chalk is overlaid by Eocene acid sands and clays. Nitrate-nitrogen content of rainwater varied 0.02-2.09 mg/l, with mean 0.31 mg/l. Rainfall could account for 3.3 kg/ha/yr NO3-N. Total sewage effluent into the River Frome increased from 0.54 cu m/sec in 1965 to 0.70 cu m/sec in 1972. (Lynch-Wisconsin)
W80-01276

STATISTICAL ASSESSMENT OF INORGANIC NITROGEN IN A SMALL RIVER SYSTEM,
Cornell Univ., Ithaca, NY.
K. S. Porter.
Progress in Water Technology, Vol 8, No 4-5, p 253-274, 1977. 7 Fig, 7 Tab, 7 Ref.

Descriptors: *Statistical models, *Nitrogen, *Lee River(England), *Nitrates, *Water pollution sources, *Inorganic nitrogen, Nutrients, Nutrient loading, Rivers, Methodology, Regression analysis, River basins, Thames River(England), Tributaries, Model studies, Time series analysis, Sewage disposal.

Detailed statistical analysis using linear models obtained by least squares methods was used with 1966-71 data from the River Lee system, England, to quantify inorganic nitrogen levels in the river and relate them to major point and nonpoint pollution sources within the watershed via linear regres-

sion. Also described are effects of such factors as time and population on nitrogen load. The River Lee, a tributary of the River Thames, has nitrate concentrations higher than in the Thames, approaching the WHO recommended limit of 11.3 mg N/l for drinking water. Analysis shows that least-squares estimation can be used quantitatively to account for concentrations and loads of inorganic nitrogen in a river system, and that factors underlying a system's features can be identified. The four main observation points were Rye House, River Stort, Dobbs Weir, and Lea Valley Road, plus the two large sewage works at Luton and Rye Meads. The more detailed analysis of data from Rye Meads demonstrated that increasing inorganic nitrogen at Lea Valley Road of about 0.54 mg/l/yr was partly attributable to the increase in population served by the works. Models indicate there could be a further rapid deterioration in the quality of the River Lea; the deterioration is the result of a larger annual increase upstream at Dobbs Weir of about 0.75 mg/l/yr inorganic nitrogen, and not of an unmeasured nitrate source between Dobbs Weir and Lea Valley Road. (Lynch-Wisconsin).
W80-01284

NITROGEN - A GROWTH LIMITING NUTRIENT IN EUTROPHIC LAKES,
National Swedish Environmental Protection Board, Uppsala. Algal Assay Lab.
A. Claesson, and S. O. Ryding.
Progress in Water Technology, Vol 8, No 4-5, p 291-299, 1977. 5 Fig, 1 Tab, 17 Ref.

Descriptors: *Eutrophication, *Water chemistry, *Bioassay, *Cycling nutrients, Limiting factor, Sewage effluents, Algae, Nitrogen, Phosphorus, Nutrients, Water quality, Chlorophyll, Selenastrum capricornutum, Sweden, Seasonal.

Water chemistry and algal assay test data from five of 18 eutrophic Swedish lakes studied May-October 1973 illustrate relationships between nitrogen and phosphorus as primary growth limiting nutrients. In less productive lakes nitrogen influences algal growth, to an extent greater than in the more eutrophic water bodies, where light or zooplankton predation limits phytoplankton growth. Analysis of the surface waters (0-2 m) displayed low concentrations of nitrogen, excess concentrations of phosphorus, and a high chlorophyll a content throughout summer periods. The most productive lakes, however, continued to exhibit a high nitrogen supply. When the total nitrogen: total phosphorus quotient was about 15:1 in lake water, phosphorus was a growth limiting nutrient, but below 15:1 nitrogen alone was the most limiting factor. Selenastrum capricornutum biomass was expressed as chlorophyll a. The sum of lake and algal assay chlorophyll was used to indicate algal growth potential in lakes and is proposed as a trophic index. (Danovich-Wisconsin)
W80-01308

NOTES ON MUDDY ODOUR. I SENSORY PROPERTIES AND ANALYSIS OF 2-METHYLISOBORNEOL IN WATER AND FISH,
Helsinki Univ., (Finland). Dept. of Limnology.
For primary bibliographic entry see Field 5A.
W80-01316

NOTES ON MUDDY ODOUR. II UPTAKE OF 2-METHLISOBORNEOL BY RAINBOW TROUT (SALMO GAIRDNERI) IN CONTINUOUS FLOW AQUARIA,
Helsinki Univ. (Finland). Dept. of Limnology.
For primary bibliographic entry see Field 5A.
W80-01317

INTERTIDAL DISPOSAL OF DREDGED MATERIAL IN WASHINGTON ESTUARIES,
Washington State Dept. of Game, Olympia.
R. Albright.
In: The Use, Study and Management of Puget Sound, A Symposium, March 23-25, 1977, University of Washington, Seattle, p. 158-172, 1977. 8 Fig, 15 Ref.

Descriptors: *Sediments, *Dredging, Dredged material, *Benthos, Amphioda, Corophium, *Shore birds, Water birds, Intertidal areas, Washington, Elevation, Animal populations, *Grays Harbor (Wash).

A study was conducted to evaluate the effects of dredging of Grays Harbor, Washington, on the organisms utilizing the area. This project was concerned with the effects of the disposal of dredged material on shore birds. The impact on the benthic community was severe. The number of species was 66% lower in the disposal area. The mean numbers of individuals and biomass was 96.7% lower than at the control stations. These changes were caused by changes in the land elevation and sediment composition. The impact on the benthic populations is expected to be permanent. The shore bird usage of the area was markedly changed. (Katz-EIS).
W80-01319

AN ASSESSMENT OF THE EFFECTS OF SUBTIDAL SEWAGE OUTFALLS ON INTERTIDAL MACROFAUNA OF SEVERAL CENTRAL PUGET SOUND BEACHES,
Washington Univ., Seattle.
For primary bibliographic entry see Field 5A.
W80-01320

IMPACT OF SEWAGE ON BENTHIC MARINE FLORA OF THE SEATTLE AREA: PRELIMINARY RESULTS,
Washington Univ., Seattle.
For primary bibliographic entry see Field 5A.
W80-01321

EFFECTS OF PROLONGED EXPOSURE TO AMMONIA ON THE BLOOD AND LIVER GLYCOGEN OF COHO SALMON (ONCORHYNCUSH KISUTCH),
Municipality of Metropolitan Seattle, WA. Water Quality Lab.
For primary bibliographic entry see Field 5A.
W80-01322

ANALYSIS OF COMBINED EFFECT OF POLLUTANTS ON BIOLOGICAL SYSTEMS,
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 5A.
W80-01323

THE INFLUENCE OF HEAVY METALS ON A MIXED BACTERIAL POPULATION OF SEWAGE ORIGIN IN THE CHEMOSTAT,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
J. N. Lester, R. Perry, and A. H. Dadd.
Water Research, Vol 13, p 1055-1063, 1979. 9 Fig, 33 Ref.

Descriptors: *Heavy metals, *Toxicity, *Sewage bacteria, Cytological studies, *Copper, *Cadmium, *Chromium, *Lead, Bacteria, Pseudomonas, Growth rates, *Chemostat.

A reproducible mixed continuous bacterial population has been cultured in the chemostat at a low dilution rate. Four species originally isolated from activated sludge were used to provide an inoculum. The influence of cadmium, chromium, copper and lead as shock doses has been examined at concentrations of 50 mg/l and the response of the population was found to vary for each metal. The most toxic metal was copper followed by cadmium, lead and chromium. Continuous doses of chromium and lead have been studied, the latter over a range of concentrations. It appears that concentrations of lead as low as 5 mg/l cause modifications in the individual population sizes. Some of the species studied were found to be more resistant to heavy metal toxicity than others. (Deal-EIS).
W80-01324

EFFECTS OF SUBLETHAL CONCENTRATIONS OF CADMIUM AS POSSIBLE INDICATORS OF CADMIUM POLLUTION FOR TWO POPULATIONS OF ACARTIA CLAUSI (COPEPODA) LIVING AT TWO DIFFERENTLY POLLUTED AREAS,
Athens Univ. (Greece). Zoological Lab. and Museum.
M. Moraitou-Apostolopoulou, G. Verriopoulos, and P. Lentzou.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 642-649, 1979. 3 Fig, 2 Tab, 16 Ref.

Descriptors: *Cadmium, *Toxicity, *Adaptation, *Copepods, Animal physiology, Animal metabolism, Heavy metals, Mortality, Respiration, Oxygen requirements, Aging(Biological), Bioindicators, *Acartia.

The purpose of this study was twofold: first to establish and characterize the sublethal effects of cadmium on different physiological processes (longevity, feeding, respiratory rates), and second to verify whether there exist differences in the effects of sublethal concentrations of cadmium between the two populations of Acartia adapted to differently polluted areas. All tested concentrations reduced longevity with respect to controls. Generally, the mean longevity declined with increasing Cd concentration. As Cd concentration increased feeding rate decreased up to a certain value, then feeding rate abruptly increased. Respiration rates and oxygen consumption increased with increasing Cd concentration. In general, the pollution-adapted population was more resistant to the effects of Cd as compared to the population from a non-polluted environment. (Deal-EIS)
W80-01329

DETOXIFICATION SYSTEM IN POLYCHAETE WORMS: IMPORTANCE IN THE DEGRADATION OF SEDIMENT HYDROCARBONS,
Skidway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 5B.
W80-01330

CONDITION INDEX AND FREE AMINO ACID CONTENT OF MACOMA INQUINATA EXPOSED TO OIL-CONTAMINATED MARINE SEDIMENTS,
Battelle Pacific Northwest Labs., Sequim, WA. Marine Research Lab.
For primary bibliographic entry see Field 5B.
W80-01331

PHYSIOLOGICAL BASIS OF DIFFERENTIAL SENSITIVITY OF FISH EMBRYONIC STAGES TO OIL POLLUTION,
Texas A and M Univ., College Station. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-01332

TOXIC CATIONS AND MARINE BIOTA: ANALYSIS OF RESEARCH EFFORT DURING THE THREE-YEAR PERIOD 1974-1976,
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5A.
W80-01333

EFFECTS OF MERCURY, CADMIUM, AND LEAD COMPOUNDS ON REGENERATION IN ESTUARINE FISHES AND CRABS,
Rutgers - The State Univ., Newark, NJ. Dept. of Zoology and Physiology.
J. S. Weis, and P. Weis.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 151-169, 1979. 5 Fig, 3 Tab, 53 Ref.

Descriptors: *Toxicity, *Heavy metals, *Crabs, *Killifishes, *Cadmium, *Mercury, Lead, Animal physiology, Animal metabolism, Mode of action, Bioindicators, Chlorides, Growth rates, Methyl mercury, *Regeneration.

Fin regeneration in the killifish, Fundulus heteroclitus, was retarded by exposure to CdCl2 at 0.01 and 0.1 mg/l. HgCl2 had no effect at levels which were sublethal. However, regeneration in F. confluentus was retarded by exposure to methylmer-

curic chloride at 0.01 and 0.05 mg/l, but the effect was reduced to insignificance when the salinity of the water was reduced or when CdCl2 was also present in the water. Regeneration of limbs in the fiddler crab, Uca pugilator, was studied after exposure to heavy metals following multiple autotomy. CdCl2 at 0.1 and 1.0 mg/l retarded the regeneration rate but HgCl2 inhibited regeneration only at 1.0 mg/l; this concentration proved lethal to many crabs. Methylmercury, however, severly inhibited regeneration at 0.5 mg/l and caused inhibition of melanogenesis in regenerates at 0.1 mg/l. Combinations of methylmercury and CdCl2 were additive in sea water. (Deal-EIS)
W80-01334

HEMATOLOGICAL EFFECTS OF LONG-TERM MERCURY EXPOSURE AND SUBSEQUENT PERIODS OF RECOVERY ON THE WINTER FLOUNDER, PSEUDOPLEURONECTES AMERICANUS,
National Marine Fisheries Service, Milford, CT. Northeast Fisheries Center.
For primary bibliographic entry see Field 5B.
W80-01335

THE USE OF BIVALVE MOLLUSCS IN HEAVY METAL POLLUTION RESEARCH,
North Carolina Central Univ., Durham. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-01336

PRELIMINARY OBSERVATIONS ON THE CYTOPATHOLOGICAL EFFECTS OF COPPER SULFATE ON THE CHEMORECEPTORS OF CALLINECTES SAPIDUS,
National Marine Fisheries Service, Oxford, MD. Northeast Fisheries Center.
For primary bibliographic entry see Field 5B.
W80-01337

COPPER AND CADMIUM INDUCED CHANGES IN THE METABOLISM AND STRUCTURE OF MOLLUSCAN GILL TISSUE,
National Marine Fisheries Service, Beaufort, NC. Southeast Fisheries Center.
For primary bibliographic entry see Field 5B.
W80-01338

FATTY ACID COMPOSITION OF PHOSPHOLIPIDS IN THERMALLY ACCLIMATING SCULPINS (LEPTOCOTTUS ARMATUS) TREATED WITH POLYCHOLRINATED BIPHENYLS (AROCLOR 1254),
Oregon State Univ., Newport. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 5B.
W80-01339

PHYSIOLOGICAL AND BIOCHEMICAL INVESTIGATIONS OF THE TOXICITY OF PENTACHLOROPHENOL TO CRUSTACEANS,
University of West Florida, Pensacola. Faculty of Biology.
For primary bibliographic entry see Field 5B.
W80-01340

A BENTHIC BIOASSAY USING TIME-LAPSE PHOTOGRAPHY TO MEASURE THE EFFECT OF TOXICANTS ON THE FEEDING BEHAVIOR OF LUGWORMS (POLYCHAETA: ARENICOLIDAE),
University of West Florida, Pensacola. Faculty of Biology.
For primary bibliographic entry see Field 5A.
W80-01341

SEASONAL MODULATION OF THERMAL ACCLIMATION AND BEHAVIORAL THERMOREGULATION IN AQUATIC ANIMALS,
Massachusetts Univ., Amberst. Dept. of Zoology.
J. L. Roberts.
In: Marne Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 365-388, 1979. 8 Fig, 62 Ref.

Descriptors: *Seasonal, *Bioindicators, *Water temperature, Animal metabolism, Oxygen requirements, Animal behavior, Respiration, Adaptation, Photoperiodism, Animal physiology, Sunfishes, Brown trout, Bullheads, Sockeye salmon, Habitats, Mode of action.

Special emphasis has been placed here on the potential of behavioral responses for indication of contaminant effects on aquatic organisms. This potential has been illustrated by the utility of shuttlebox aquariums for determination of thermal preferenda. Thermal preferenda have been identified as ranges in temperature at which aquatic organisms do not receive thermal feedback from the environment that is inductive of aversive or avoidance responses. The thermal preferendum of a species is liable to modification by seasonal changes in temperature and probably as well by photoperiod change. The fact that locomotory activity of aquatic ectotherms can increase in some proportion with the magnitude of temperature change above and below a seasonal thermal preferendum (averse responses) suggests that behavioral thermoregulation in subject to a sort of central proportioning control. That is, a variable set-point thermostat does not seem to provide an appropriate analogue for the control system. (Deal-EIS)
W80-01342

EFFECT OF DIMILIN ON DEVELOPMENT OF LAKE LARVAE OF THE STONE CRAB MENIPPE MERCENARIA, AND THE BLUE CRAB, CALLINECTES SAPIDUS,
Duke Univ., Beaufort, NC. Marine Lab.
J. D. Costlow.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press New York, p 355-363, 1979. 2 Fig, 18 Ref.

Descriptors: *Pesticide toxicity, *Larval growth stage, *Crabs, Insecticides, Bioassay, Salinity, Water temperature, Mortality, Path of pollutants, *Dimilin.

Larvae of the two crabs species were exposed to four concentrations of Dimilin (0.5, 1.0, 3.0, 6.0 ppb) at six combinations of temperature and salinity. All experimental concentrations were lethal to the larvae of the stone crab. Blue crab survival showed considerable variation, both in relation to the concentration of Dimilin and relative to the salinity/temperature combination. From the results of this work, as well as the limited observations on other non-target organisms, it is apparent that Dimilin, while a highly effective insecticide, must be used with extreme caution in areas which serve as a watershed to estuarine and coastal waters. (Deal-EIS)
W80-01343

SEASONAL EFFECTS OF CHLORINE PRODUCED OXIDANTS ON THE GROWTH, SURVIVAL AND PHYSIOLOGY OF THE AMERICAN OYSTER, CRASSOSTREA VIRGINICA (GMENLIN),
National Marine Water Quality Lab., John's Island, SC.
G. I. Scott, and W. B. Vernberg.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p 415-435, 1979. 7 Fig, 3 Tab, 29 Ref.

Descriptors: *Oysters, *Toxicity, *Chlorine, Mortality, Seasonal, Water temperature, Animal physiology, Animal metabolism, Respiration, Animal behavior, Bioassay, Growth rates, Mode of action, *Tissue analysis.

Chronic exposure of Crassostrea virginica to chlorine produced oxidant (CPG) products is highly toxic at high concentrations; severe sublethal effects occur at low concentration levels. The degree of toxicity, however, varies from season to season and is related to seasonal changes in measured CPO concentrations, water temperatue, and the physiological condition of the oyster. The combination of various CPO concentrations and high water temperatures significantly decreased survival and increased respiration rates in exposed oysters, probably due to a sublethal synergistic physiological stress and a lethal synergistic effect on survival due to the interaction of these factors. Other sublethal effects appear to be related to reductions in feeding and increased avoidance of CPO which results in reduced levels of tissue production. (Deal-EIS)
W80-01344

BEYOND THE LC50: AN OPINION ABOUT RESEARCH ACTIVITIES AND NEEDS CONCERNING PHYSIOLOGICAL EFFECTS OF POLLUTANTS IN THE ENVIRONMENT,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
For primary bibliographic entry see Field 5B.
W80-01345

CADMIUM TOXICITY TO FRESHWATER ALGAE,
Canada Centre for Inland Waters Burlington (Ontario).
P. T. S. Wong, G. Burnison, and Y. K. Chau.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 487-490, 1979. 2 Fig, 10 Ref.

Descriptors: *Cadmium, *Toxicity, *Bioindicators, Monitoring, Aquatic algae, Chlorella, Scenedesmus, Growth rates, Absorption, Cytological studies, Radiochemical analysis, Tracers.

The effect of cadmium, as Cd nitrate, Cd chloride, Cd carbonate and Cd acetate, on ceil growth was examined in four algal species (Ankistrodesmus falcatus, Chlorella vulgaris, Scenedesmus quadricauda and Chlorella pyrenoidosa). The effect of Cd chloride on 14C-carbonate uptake by all four algal species was also tested. No cell growth was found above a concentration of 5 ppm Cd. The toxicity of Cd was more marked in bay water than a culture medium for any of the four Cd salts tested. In the uptake experiment it was reported that the different algal species responded differently to Cd. For S. quadricauda the presence of Cd as low as 20 ppb inhibited 80% of its 14C-uptake. The other three species were less sensitive to Cd. (Deal-EIS)
W80-01347

THE EFFECT OF EXPOSURE TEMPERATURES ON OXYGEN CONSUMPTION AND OPERCULAR BREATHING RATES OF PINK SALMON FRY EXPOSED TO TOLUENE, NAPHTHALENE, AND WATER-SOLUBLE FRACTIONS OF COOK INLET CRUDE OIL AND NO. 2 FUEL OIL,
California State Univ.-Chico. Dept. of Biological Science.
R. E. Thomas, and S. D. Rice.
In: Marine Pollution: Functional Responses, Vernberg, W. B., A. Calabrese, F. P. Thurberg and F. J. Vernberg, Eds., Academic Press, New York, p. 39-52, 1979. 4 fig. 18 ref.

Descriptors: *Fish physiology, *Toxicity, *Oil, Organic compounds, Fuels, Pink salmon, Fry, Oxygen requirements, Respiration, Fish behavior, Animal metabolism, Mode of action, *Toluene, *Napththalene, *Crude oil.

All three concentrations of naphthalene (107%, 70%, and 45% of the 24-h TLm) resulted in significant increases in the opercular breathing rate of pink salmon fry, while of the four toluene concentrations (94%, 69%, 45%, and 30% of the 24-h TLm), only the two highest resulted in a significant increase in the breathing rate. The two higher napthalene concentrations resulted in significant increases in breathing rate for the entire 25-h exposure but only the highest toluene concentration caused a significantly elevated respiratory rate for the entire 15-h period, even though the exposure concentration in all of these tests were stable. Some fry died during the exposure to the highest concentrations of napthalene and toluene. Oxygen consumption and breathing rates of fry exposed to

toluene and napthalene began to increase immediately upon exposure and declined later hours during exposure. Breathing rate reached maximum response values at 2 or 4 h, while the oxygen consumption rates were greatest at 6 or 8 h of exposure. The breathing rate responses to exposures of Cook Inlet crude oil WSF and No. 2 fuel oil WSF at 4 and 12C are similar to the responses of fry exposed to toluene and napthalene. The effect of temperature on breathing rate response to No. 2 fuel oil was approximately the same as observed in tests with napthalene. (Deal-EIS)
W80-01348

SEDIMENT AND WATER QUALITY: A REVIEW OF THE LITERATURE INCLUDING A SUGGESTED APPROACH FOR WATER QUALITY CRITERIA WITH SUMMARY OF WORKSHOP AND CONCLUSIONS AND RECOMMENDATIONS,
Washington Univ., Seattle. Fisheries Research Instt.
R. N. Iwamoto, E. O. Salo, M. A. Madej, and R. L. McComas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 469, Price codes: A12 in paper copy, A01 in microfiche. Report EPA 910/9-78-048, February 1978. 252 p, 4 Append.

Descriptors: *Sedimentation, *Water quaity, *Turbidity, *Lotic environment, *Conferences, *Bibliographies, Sediment transport, Sediment load, Sediments, water circulation, Publications, Bed load, Productivity, Streams, Aquatic life, Land use, Movement, Flow, Seattle(WA), Federal Water Pollution Control Act.

While turbidity measurements indicate suspended sediment quantities, turbidity is difficult to relate to significant biological changes. Alternative approaches to turbidity measurements as a water quality criterion include: bed material composition, aquatic fauna behavioral aspects, and stress measured clinically by physiological functions. Bed material composition, principally the percentage of fines less than 0.850 mm diameter, affects primary and secondary productivity. A 10% to 20% limit for sediments less than 0.850mm is suggested as a criterion. Gravel for spawning produces significant detrimental effects on salmonid resources. A literature review summary, with 300 annotated and 100 unannotated referenvces, dealing with physical and biological aspects of sedimentation in the logic environment is included. Some states have adopted forest 'best management practices' which allow for flexible standards. Consensus of workshop held in Seattle Washington, 10 March 1977, included updating and monitoring best management practices and continued investigation of alternative approaches for water quality criteria. (Danovich-Wisconsin)
W80-01349

NITRATE UTILIZATION BY THEMATOM SKELETONEMA COSTATUM, I. KINETICS OF NITRATE UPTAKE,
Bilbao Univ., (Spain). Dept. of Biochemistry.
J. L. Serra, M. J. Llama, and E. Cadenas.
Plant Physiology, Vol 62, No 6, P 987-990, December 1978, 6 Fig, 25 Ref.

Descriptors: *Nitrates, *Diatoms, *Kinetics, Metabolism, Phytoplankton, Growth rates, Biochemistry, Microbiology, Marine algae, Nitrates, Ammonium salts, Bioassay, Michaelis-Meuten equations, Chemical analysis, Cycling nutrients, Nutrients, Nutrient requirements.

Nitrogen-deficient cells of Skeletonema costatum do not follow classical saturation kinetics when nitrate concentrations become higher than six micro M, but a high Vi nitrate value is obtained due to the additive, simultaneous contribution of a linear simple diffusion and a hyperbolic saturation transfer, with a carrier of nitrate. Cycloheximide and p-hydroxymercuribenzoate inhibit the carrier-mediated component to nitrate uptake without affecting the diffusion component. This paper characterizes nitrate uptake kinetics in Skeletonema costatum, phytoplankton organism ecologically significant because of its wide distribution. When N-deficient cells are preincubated four h with one micro M NaNo3, nitrate uptake increases and nitrate release decreases with a net increase in N assimilation. This can be explained by assuming that the permease, and/or nitrate and nitrite reductases, is nitrate-inducible. In preincubated cells, these protein cellular levels are higher than in non-preincubated cells, leading to increaed N assimilation. Nitrate is excreted following classical saturation kinetics, its rate being independent of nitrate concentration for values higher than three micro M. Uptake rates of nitate or ammonium by marine phytoplankton yield hyperbolae when plotted against the external nitrate or ammonium concentration. (Danovich-Wisconsin) (See also W80-01351)
W80-01350

NITRATE UTILIZATION BY THE DIATOM SKELETONEMA COSTATUM, II. REGULATION OF NITRATE UPTAKE,
Bilbao Univ. (Spain). Dept. of Biochemistry.
J. L. Serra, M. J. Llama, and E. Cadenas.
Plant Physiology, Vol 62, No 6, P 991-997, December 1978. 4 Fig, 25 Ref.

Descriptors: *Kinetics, *Nitrate, *Diatoms, *Plant physiology, Nutrients, Cycling nutrients, Nitrate, Ammonium salts, Nitrogen, Nitrogen cycle, Cycling nutrients, Biochemistry, Microbiology, Growth rates, Productivity, Chemical analysis, Phytoplankton, Amino acids, Metabolism, Cytological studies.

This paper deals with the effect of ammonium, nitrate, and amino acids on the isolated nitrate uptake system, once nitrate reductase activity has been inhiabited by tungstate, on N-deficient cells of the marine diatom Skeletonema costatum. Tungstate partially alters carrier-mediated nitrate uptake, but diffusion uptake remains unchanged. Cells were preincubated with CHI or with NEM and in both cases the contribution of carrier-mediated hyperbolic transport was negligible, while linear diffusion processes remained unaltered. Ammonium readily affects nitrate uptake in the same way as CHI and NEM; these results explain the partial inhibition by ammonium of permease for nitrate uptake. However, nitrate did not affect nitrate uptake kinetics type. Nitrate uptake was assayed separately in darkeness and in the presence of amino acids and no inhibition was found. A model is proposed for regulation of nitrate assimilation by S. costatum. The permease responsible for nitrate transfer might be the same carrier responsible for nitrate release but with different affinities for both ions in the inner and outer membrane faces. The permeases and the nitrate reductase might together make up a nitrate transfer-reduction system. CHI, NEM, p-HMB and tungstate affect, although in different ways, the three functions (two transfers plus reduction) simultaneously and may be performed by a single system. The increase in nitrate uptake and decrease in nitrate release can be explained by assuming the system and nitrate reductase are both nitrate-inducible and CHI sensitive. (See also W80-01350) (Danovich-Wisconsin)
W80-01351

CHEMICAL COMPOSITION OF AQUATIC MACROPHYTES, I. INVESTIGATION OF ORGANIC CONSTITUENTS AND NUTRITIONAL POTENTIAL,
Guelph Univ. (Ontario). Coll. of Biological Science.
A. J. Muztar, S. J. Slinger, and J. H. Burton.
Canadian Journal of Plant Science, Vol 58, No 3, p 829-841, July 1978. 5 Tab, 23 Ref.

Descriptors: *Aquatic plants, *Lake Ontario, *Chemung Lake, Canada, *Chemical analysis, *Feeds, *Fibers, *Beneficial use, *Aquatic weed control, Canada, Silage, Energy, Biochemistry, Speciation, Proteins, Plant Physiology, Plant tissues, Growth stages, Nutrients, Cellulose.

Chemical studies of four aquatic plant species from Chemung Lake, Ontario and from Lake Ontario during summer 1974 show that aquatic plant utilization from hard water lakes is a limited nutrient source for domestic animals because of high water and ash contents. High ash content is mostly due to surface contamination and can be reduced by washing, thus increasing nutritive value but also involving additional costs. Various chemical constituents such as gross energy and proximate components (crude fiber, crude protein, ash) and variation of these components with harvesting time were determined for Myriophyllum spicatum, Vallisneria americana, Potamogeton sp and Cladophora glomerata. Ash content ranges from 16% for Potomogeton harvested in July to 63.7% for M. spicatum in the same month. No general trend for ash variation with harvesting time is obvious; ash content increases only in Potamogeton at later harvest times. Crude protein levels vary from 7.7% for M. spicatum harvested in August to 18.3% for V. americana cut in September. Crude fiber levels fluctuate in all species over the three harvesting times with a 9.8% low and 24.04% high. Gross energy values fluctuate from 1.77 kcal/g for M. spicatum in July to 4.03 kcal/g for Potamogeton in August. Neutral-detergent fiber level is lowest for M. spicatum collected in August (14.2%) and highest for Potamogeton (52%) harvested in August-September. Acid-detergent fiber content ranges from 13.7% for M. spicatum in August to 41.4% for C. glomerata in September. Cellulose levels fluctuate from 11 to 26%. (Danovic-Wisconsin)
W80-01352

CHEMICAL COMPOSITION OF AQUATIC MACROPHYTES. III. MINERAL COMPOSITION OF FRESHWATER MACROPHYTES AND THEIR POTENTIAL FOR MINERAL NUTRIENT REMOVAL FROM LAKE WATER,
Guelph Univ. (Ontario). Dept. of Nutrition.
A. J. Muztar, S. J. Slinger, and J. H. Burton.
Canadian Journal of Plant Science, Vol 58, No 3, p851-862, July 1978. 6 Tab, 34 Ref.

Descriptors: *Aquatic plants, *Chemical analysis, *Metals, *Hardness(Water), *Nutrient removal, Canada, Lake Ontario, Chemung Lake, Canada, Specification, Plant physiology, Growth stages, Aquatic weed control, Alfalfa, Feeds, Silage, Nutrients, Calcium carbonate, Calcium compounds, Calcium, Copper.

Physiological needs, growth stage, and water fertility were critical factors in aquatic macrophyte nutrient composition in a summer 1974 and 1975 study of five species from Chemung Lake and Lake Ontario, Canada. The study investigates variations and differences in mineral content and mineral-stripping potential of aquatic macrophytes with species and harvesting time. Species observed include Cladophora glomerata, Myriophyllum spicatum, Lemna minor, Potamogeton, and Vallisneria americana. Calcium (CA) contents range from 5% for V. americana harvested in September to 23.7% for M. spicatum cut in July. High CA levels result from CaC03 deposition on plant surface tissues; unwashed plants contain 2-6 times more Ca than washed plants. In all plants species samples, washed or unwashed, Ca levels vary almost directly with ash contet. Sodium (Na) levels increase considerably with harvesting time from July onwards in all species; however, M. spicatum and V. americana harvested in September represent a second cutting. Levels of Cu, Zn, and Mn are variable with Cu (1-31 ppm) and Mn (34-1998 ppm) ranges particularly large. Compared with alfalfa, aquatic macrophytes contain much higher Fe, Ca, Na, and Mn levels but slightly lower P, K, and Se levels: Mg, Cu, and Zn levels are present in similar quantities. Analyses indicate that significant mineral quantities are removed from lakes by mechanical plant harvesting. Mature plants have low nutritive value as animal feedstuffs because of high ash content but can be used for mulch or compost material. (Danovich-Wisconsin)
W80-01353

THE RELATIONSHIP BETWEEN INORGANIC AND ORGANIC NUTRIENTS IN SEA WATER,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
E. I. Butler, S. Knox, and M. I. Liddicoat.
Journal of the Marine Biological Association of the

United Kingdom, Vol 59, No 1, p 239-250, 1979. 3 fig, 6 Tab, 34 Ref.

Descriptors: *Nitrogen, *Phosphorus, *English Channel, *Cycling nutrients, Nutrients, Water chemistry, Phytoplankton, Productivity, Speciation, Nitrates, Phosphates, Nutrient budgets, Nitrogen compounds, Inorganic compounds, Organic compounds, Phosphorus compounds, Nutrient requirements, Sea water.

An 11-year study indicates that waters in the western English Channel always contain some form of dissolved nitrogen (N) and phosphorus (P). As one dissolved N form, nitrate (NO3), is utilized, another dissolved N fraction, dissolved organic nitrogen (DON), usually increases. While NO3 values decrease from 7.0 micro g/l monthly average in winter to 0.5 micro g/l in summer, DON usually increases from a 4.5 micro g/l winter monthly average to 10.0 micro g/l in summer. However, P curves do not show trends as clearly as those of N. Average monthly values range in January, July and October from 0.52 to 0.21 to 0.38 micro g/l for phosphate, respectively, and 0.15 to 0.21 to 0.14 micro g/l for dissolved organic phosphorus, respectively. Some phytoplankton species directly utilize at least part of DON, such as urea. As NO3 is exhausted, phytoplankton populations may shift to species capable of utilizing other N forms, throwing doubt on classical nutrient limiting growth theories. Results also show a relatively constant twenty to one TN:TP ratio throughout the year, TN varies from 11.6 to 9.9 to 10.4 micro g/l and TP varies from 0.67 to 0.42 to 0.55 micro g/l for monthly averages in January, July, and November, respectively. (Danovich-Wisconsin)
W80-01354

A REAL TIME MODEL OF NITROGEN-CYCLE DYNAMICS IN AN ESTUARINE SYSTEM,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
T. O. Najarian, and D. R. F. Harleman.
Progress in Water Technology, Vol 8, No 4-5, p 323-345, 1977. 26 Fig, 7 Tab, 12 Ref.

Descriptors: *Computer models, *Nitrogen cycle, *Estuaries, *Effluents, Hydrodynamics, Water quality, Computer simulation, Waste water discharge, Phytoplankton, Aquatic system, Tidal flow, Zooplankton, Estuarine environment, Model studies, Cycling nutrient.

A computer analysis of the response of an estuary to the input of waste water treatment effluent reveals the importance of coupling tidal transparent dynamics with biochemical and ecological processes. A real-time model obtains better results than a tidal average model because it realisticaly simulates ocean boundary conditions. The real time model explains effluent transport upstream of the point of injection due to flow reversal in the estuary caused by tides. An analysis of simple batch systems reveals the structured closed loop nitrogen-cycle has limit cycle characteristics; system response depends on whether or not it is open to matter flow; system variations occur with changes in parameters which govern the rate of transformation processes. Three objectives were established in formulating the study: (1)presenting a developed model for aerobic nitrogen limited aquatic systems; (2) predicting the estuaring response to future increases in waste water treatment facilities, and (3) coupling transport dynamics with nitrogen cycle dynamics. Ths basic principle of mass conservation of nitrogen was applied to various storage forms of the nutrient throughout its cycle. This closed loop nitrogen cycle model is important for estuarine phytoplankton dynamics. Seven storage variables and twelve biological and ecological transformations of nitrogen from one storage form to another were used in through-flow and unsteady-flow runs. Transformation rates were functions of nutrient concentrations and available energy levels. (Danovich-Wisconsin)
W80-01355

THE FAUNA OF THE MUDDY SEDIMENTS OF LOUGH NEAGH, WITH PARTICULAR REFERENCE TO EUTROPHICATION,
New Univ. of Ulster, Coleraine (Northern Ireland). Limnology Lab.
C. E. Carter.
Freshwater Biology, Vol 8, No 6, p 547-559, December 1978. 11 Fig, 2 Tab, 20 Ref.

Descriptors: *Estrophication, *Sediments, *Diptera, *Benthic fauna, *Oligochaetes, Bottom sediments, Lake sediments, Tubificids, Oxygen, Productivity, Bioindicators, Dominant organisms, Ecological distribution, Environmental effects, Biomass, Northern Ireland, Lakes, Water pollution effects, Invertebrates, Lough Neagh, Northern Ireland.

Benthic fauna of Lough Neagh, North Ireland, are not stable but are undergoing long-term changes as evidenced by sub-fossil records, and short-term changes as evidence in deeper waters (25 m) and more enriched areas. In the last century Tanytarsus has been replaced by Chironomus and that change will continue with C. plumosus replacing C. anthracinus, decreasing chironomid numbers, with perhaps Procladius becoming most abundant. Sampling took place at 2-4 week intervals from November 1974-November 1976 and was restricted to muddy lake sediments and Kinnego Bay, an almost enclosed bay substantially enriched by sewage effluent. Two main groups found at all sites are Chironomidea (Diptera) and Oligochaeta (mainly Tubificidae). Fauna are more restricted at greater depths with C. plumosus replacing C. anthracinus and tubificids, particularly Limnodrilus, more abundant. Procladius is the most common chrionomid in Kinnego Bay with C. plumosus and C. anthracinus. Fauna respond to increasingly difficult conditions in terms of oxygen depletion and nutrient enrichment. The average biomass of chironomids and tubificids is: 3.9 g sq m at eight m, 13.2 g sq m at 25 m, and 2.8 g sq m in Kinnego Bay. At eight m, C, anthracinus contributes 74% of the biomass; at 25 m, tubificids (Limnodrilus) contribute 74% and C. athracinus 15%; in Kinnego Bay, Limnodrilus contributes 40%, C. plumosus 38% and Procladius 20%. (Danovich-Wisconsin)
W80-01356

THE EFFECT OF SEWAGE ON UPTAKE OF INORGANIC NITROGEN AND CARBON BY NATURAL POPULATIONS OF MARINE PHYTOPLANKTON,
Biglow Lab. for Ocean Science, West Boothbay Harbor, ME.
J. J. MacIsaac, R. C. Dugdale, S. A. Huntsman, and H. L. Conway.
Journal of Marine Research, Vol 37, No 1, p 51-56, February 1979. 7 Fig, 5 Tab, 29 Ref. NSF GB-18568, BG-35880X, DEB 76-199 60 OCE 76-001 36

Descriptors: *Carbon, *Nitrogen, *Phytoplakton, *Sewage effluents, *Primary productivity, Nutrients, Nutrient requirments, California, Ammonium salts, Sewage, Poductivity, Carbon cycle, Nitrogen cycle, Growth rates, Kinetics, Mathematical studies, Nitrates, Photosynthesis.

Complex effects on phytoplankton from sewage effluent added to the sea through marine diffusers is shown in the study of two outfalls near Los Angeles and Santa Monica, California, March-April 1972. While sewage-generated N ultimately shouls stimulate primary production in this N-limited region, the study demonstrates that some sewage qualities actually impair N productivity; suppression of nitrate uptake is due to elevated ammonium levels and ammonium uptake suppression is caused by unspecified properties in the sewage itself. At low nutrient concentrations (one part effluent to 2,500 parts seawater), population responses are positive and very similar. However, at higher enrichments (one part effluent to 25 parts seawater), ammonium uptake in sewage is clearly suppressed. N and C uptake processes are independent; C uptake is relatively constant in comparison to changes in ammonium uptake. The ratio of C to N uptake is high when N supply is low, rapidly decreasing with the nutrient supply. Inhibition of ammonium uptake, and growth eventually, occurs when sewage-added ammonium levels are 10-100 microg-at 1; carbon uptake is reduced only at the highest level. Growth rate may be affected by much lower amounts of effluent than is carbon fixation and ammonium dependence may be forced even at very low effluent levels, possibly affecting phytoplankton species composition due to a single N source. (Danovich-Wisconsin)
W80-01357

DIURNAL DISTRIBUTION OF PHOTOSYNTHETIC PIGMENTS AND PLANKTONS IN RELATION TO ENVIRONMENTAL PARAMETERS IN THE MALAD CREEK, BOMBAY,
Central Inst. of Fisheries Education, Bombay (India).
O. P. Bohra, K. H. Ali, and S. N. Dwivedi.
Comparative Phsiology and Ecology, Vol 3, No 4, p 207-211, 1978. 19 Fig, 4 Tab, 4 Ref.

Descriptors: *Bombay, India, *Malad Creek, *Plankton, *Tidal effects, *Diurnal distribution, *Hydrobiology, Distribution, Primary productivity, Zooplankton, Phytoplankton, Chlorophyll, Chlorophyta, Copepods, Crustaceans, Dissolved oxygen, Tides, Transparency, Nutrients, Nitrates, Phosphates, Plant pigments.

Malad Creek, an estuary near Bombay India with 4.6 to 11.5 m water fluctuations, was investigated December 1976 for diurnal rhythm patterns of hydrobiological parameters. Tidal influence varies 0.62 m (1740 h) to 4.27 (2355 h) and minimum secchi disc reading is 33 m compared to a maximum 92 cm after high tide. Dissolved oxygen values fluctuate 0 to 7.459 ml; low values result from domestic and industrial effluents discharged into the estuary. Water is low in phosphate content (0.180-1.088 micro g at/1). Nitrate concentrations dominate with 30.0 micro g at/1 maximum and 2.75 micro g at/1 minimum. Silicate values range from 0.32 to 0.70 mg/1. Chlorophyta phytoplankton Ulothrix dominates; Navicula, Fragillaria, Coscinodiscus, Pleurosigma, and Nitzschia are also present. Maximum numbers (125,760/1) occur at 1600 hr and phytoplankton disappear at midnight, just after high tides. Total chlorophyll concentration ranges 12.0 to 66.64 mg/cu m and chlorophyll-a, the dominating pigment, varies 5.16 to 34.50 mg/cu m. Net and gross primary productivity values are 2.61 g C/cu m/d and 2.86 g C/cu m/d, respectiely. Total zooplankton numbers vary between 37 ind/1001 ko 385 ind/100 1. Zooplankton population is composed of Copepods and cladocera with Diaptomus dominating. (Danovich-Wisconsin)
W80-01358

ARTIFICIAL UPWELLING AND PHYTOPLANKTON PRODUCTION IN ALASKA,
Alaska Univ., Seward. Inst. of Marine Science.
A. J. Paul, J. M. Paul, and P. A. Shoemaker.
Marine Science Communications, Vol 5, No 1 p 79-89 1979. 1 Tab, 8 Ref.

Descriptors: *Primary productivity, *Alaska, *Phytoplankton, *Upwelling, Productivity, Diatoms, Growth rates, Subarctic, Fjords, Nutrients, Nutrient requirements, Fish management, Flow rates, Pumping, Thermocline.

Phytoplakton counts up to 35,000 cells/ml were artificially induced by flushing an Alaskan pond at a rate of 35% per day with nutrient rich seawater taken from below a subarctic fjord themocline. At flushing rates of only 2% per day, southcentral Alaskan spring bloom phytoplankton population levels could be artifically induced in a salt water impoundment. An Alaskan fjords annual primary production generally occurs during a short early spring bloom with cell counts averaging 1500 cells/ml. Following this bloom a thermocline develops, nutrients are depelted by plant growth, and summer fjord phytoplankton population density may decline to one cell/ml at a time when temperature is highest and if adequate food was available, the growth of filter feeders and grazers would be most rapid. However, nutrients are continually present below the thermocline and impoundment tidal power and wind and wave driven pumps are two mechanisms suggested for artificial upwelling. This 1977 experiment monitored phytoplankton growth in a 1,000,000 liter salt water pond flushed at a rate of 2% per day with sea water having NO2+NO3 levels of 12.5 micro g at/l and P04

levels of 1.3 micro g at/1. After increasing flushing rates 10%, 20%, and 35% per day, phytoplankton cell counts increased to 7,8000, 20,000, and 35,000 cells/ml respectively, and this bloom was maintained for five months. The phytoplankton species occuring in the upwelling pond were the general Bacteriosira, Chaetoceros, Cylindrotheca, Skeletonema, Thalassiosira and various pennate diatoms. (Danovich-Wisconsin)
W80-01359

SPARTIAL VARIATION IN EPILITHIC ALGAE IN A STONY STREAM (WILFIN BECK) WITH PARTICULAR REFERENCE TO COCCONEIS PLACENTULA,
Freshwater Biological Association, Winderemere (England).
J. G. Jones.
Freshwater Biology, Vol 8, No 6, p539-546, 1978. 6 Fig, 1 Tab, 22 Ref.

Descriptors: *Diatoms, *England, *Sewage effluents, *Streams, *Distribution, Algae, Standing crops, Flow, Effluents, Phytoplankton, Sewage, Agricultural runoff, Farm wastes, Surface wastes, Population, Chyrsophyta, Periphyton, Seasonal, Distribution patterns, Ecological distribution, Rainfall.

Water flow, as measured by rainfall, has a marked effect on epilithic algae numbers 1973-1974 in Wilfin Beck, a stony English stream; mean Cocconeis placentula counts decrease with increasing rainfall. This paper examines epilithic algae distribution in the stream with epifluorescence techniques. The stream receives organic enrichment from a trickling filter sewage treatment plant and grazing cattle. Sewage effluent normally contains one mg/l soluble reactive phosphorus, 1.2 mg/l ammonia, and eight mg/1 nitrates. Immediately below the outfall, a sewage fungus community comprised of Sphaerotilus natans occurs; stalked ciliates dominate. During summer, encrusting red algae Hildenbrandtia rivularis and juvenile Batrachospermum stages are observed; encrusting green and blue-green algae, particularly Oncobyrsa rivularis, are also more frequent in downstream outfall areas. Clean surfaces placed above and below the discharge show significantly higher Cocconeis cell numbers below the outfall. Cocconeis counts below sewage outfalls tend to be highest in autumn whereas other diatom counts are highest in spring. Grazing cattle have marked effects on water chemistry, and for short periods, on epilithic flora composition. A clear increase in Cocconeis colonization rates from 12,950 to 30,060 cells/sq cm/d occurs up to a certain grade of stone roughness. Results are extremely variable and apart from nutrient input effects Cocconeis standing crops are largely related to water flow rates. (Danovich-Wisconsin)
W80-01360

LIFE-HISTORY AND DISTRIBUTION OF SIMULATION AUSTENI (DIPTERA: SIMULIIDAE) IN RELATION TO PHYTOPLANKTON IN SOME SOUTHERN ENGLISH RIVERS,
Freshwater Biological Association, Wareham (England). River Lab.
R. G. Hansford.
Freshwater Biology, Vol 8, No 6, p 521-531, 1978. 5 Fig, 6 Tab, 31 Ref.

Descriptors: *England, *Diptera, *Distribution, *Rivers, *Life history studies, *Public health, Diatoms, Phytoplankton, Speciation, Growth stages, Seasonal, Productivity, Population, Competition, Ecological distribution, Distribution patterns, Algae, Larvae, Larval growth stages, Aquatic insects.

Simulium austeni, a univoltine man-biting species, is characteristic of the weedy middle and lower reaches of the Stour River, near Dorset, England; however, its distribution does not correlate well with phytoplankton availability, which varies considerably year to year. This February 1973 to May 1975 study examines the life-history and larvae distribution of this species which first created a problem in the 1960s and became worse around 1971. The Stour River is unpolluted and has a 95 km total length and 25-30 m maximum width. Nine Simulium species were recorded: S. austeni produces a single pupae peak from mid-April to mid-May each year, while other species have three generations per annum. S. austeni competes larval development prior to mature early summer larval production by multivoltine species, thus avoiding competition with them. Stephanodiscus hantzschii, which has reached high concentrations since 1948, the most abundant spring diatom, reached 37,000 cells/ml in April 1973 and even higher levels in May, 1975. Phytoplankton are rarely present for the entire S. austeni larval development period. Stour tributaries supporting S. austeni have relatively low suspended algae concentrations. Elsewhere in the area, S. austeni is never numerically dominant and is often uncommon. Simuliid species distribution with respect to water chemistry is poorly understood, however, Stour nitrate concentrations have doubled in the last decade. (Danovich-Wisconsin)
W80-01361

THE BIOLOGY OF CANADIAN WEEDS. 34. MYRIOPHYLLUM SPICATUM L.,
Minnesota Univ., St. Paul. Dept. of Botany.
For primary bibliographic entry see Field 4A.
W80-01362

A REVIEW OF THE LITERATURE ON SEDIMENT: WATER EXCHANGE OF NITROGEN COMPOUNDS,
Copenhagen Univ. (Denmark). Freshwater Biological Lab.
L. Kamp-Nielsen, and J. M. Anderson.
Proress in Water Technology, Vol 8, No 4-5, p 393-418, 1977. 1 Fig, 3 Tab, 89 Ref.

Descriptors: *Sediments, *Nitrogen, *Sediment-water interfaces, *Nitrogen cycle, *Reviews, Lakes, Soils, Ammonia, Nitrogen fixation, Nitrification, Denitrification, Nutrient transport, Cycling nutrients.

This literature review illustrates that while much information exists regarding sediment-water exchange of nitrogen compounds and the influence of environmental parameters, knowledge is lacking on the relative importance of various processes in nitrogen transformation in sediments. Information on the nitrogen cycle is needed if predictions are to be made on consequences of alterations in nitrogen loading to water bodies. The review concentrates on lakes because their retention time is long compared with river systems. Research on nitrogen exchange has followed two directions: work with undisturbed sediment cores, and work with mixed sediment-water systems. Combining the two methods by system analysis and the development of realistic models of the exchange processes are suggested for further research. Nitrogen in the upper layers of the sediment is 80% organic and 20% inorganic. Annual gross sedimentation rates of nitrogen range 3.5 g N/sq m to 30 g N/sq m. The primary nitrogen cycling process in sediments is degradation and mineralization of organic matter. The major pathway for ammonification in lake sediments is bacterial cycling. Anaerobic ammonia liberation rates vary from 3.4-13.7 mg ammonia/sq m/d in Danish lakes to 73 mg ammonia/sq m/d in Lake Trummen, Sweden. Nitrogen fixation, nitrification, denitrification, and rate limiting processes for nitrogen exchange in natural waters are also discussed. (Danovich-Wisconsin)
W80-01363

POLLUTANS LOADINGS IN URBAN STORM WATER,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
For primary bibliographic entry see Field 5B.
W80-01364

A POSSIBLE CORRELATION BETWEEN ALGAL NUMBER AND S. GALILAEUS YIELD IN THE KINNERET,
Hebrew Univ., Jerusalem (Israel) Dept. of Zoology.
K. Reich.
Bamidgeh: Bulletin of Fish Culture of Israel, Vol 30, No 4, p 116-117, 1978. 1 Fig, 1 Tab, 1 Ref.

Descriptors: *Lake Kinneret Israel, *Algae, *Fish food organisms, *Fish populations, Correlation analysis, Biomass, Growth rates, Nutrient requirements, Fish, Fish harvest, Fish diets.

Comparison of Sarotherodon galilaeus catch fluctuations and annual algal biomass fluctuations in Lake Kinneret, Israel, from 1969 to 1977 reveals no correlation, but a parallel nevertheless exists between peridinium algal quantities and S. galilaeus catch after two years. S. galilaeus catch is a function of algal numbers present during its hatching. Since catches consist mainly of second-year-old fish, its number is determined by algal populations size present two years earlier. However, fluctuations in algal biomass and fish numbers may be induced by some unknown factor such as water temperature, rainfall distribution, or water levels. Even if correlation between the two phenomena is not causative, they are parallel and mean annual algal numbers serve as a basis for predicting S. galilaeus catches two years later. (Danovich-Wisconsin)
W80-01365

ASPECTS OF CO2-FIXATION IN SOME FRESHWATER RHODOPHYCEAE,
Cologne Univ. (Germany, F. R.). Botanisches Inst.
B. P. Kremer.
Phycologia, Vol 17, No. 4 p 430-434, December 1978. 4 Fig, 1 Tab, 21 Ref.

Descriptors: *Rhodophyta, *Photosynthesis, *Temperature, *Freshwater, Algae, Aquatic algae, Biochemistry, Light, Carbohydrates, Plant physiology, West Germany, Ecological distribution, Adaptation.

The soluble carbohydrates floridoside and trehalose show increasing C14 labeling over time and, therefore, are the most striking and products of photosynthetic carbon reduction in freshwater Rhodophyceae collected from habitats near Cologne, West Germany. This ecologically specialized group of red algae thus differs from marine species, which exclusively accumulate either floridoside or mannosidoglycerate depending upon their taxonmic position. The paper quantifies assimilation rates of red freshwater algae Compsopogon hookeri, Batrachospermum boryanum, and Lemanea annulata, as to how far they resemble marine Rhodophyceae, with special attention to temperature conditions and main accumulation products of photosynthetic carbon reduction. Compsopogon achieves optimal photosynthetic rates at temperatures between 30C and 40C, a maximum at 35C, decreasing abruptly at temperatures exceeding 40C. The maximum rate of light dependent C assimilation in Lemanea annulata is a 25C, decreasing rapidly at temperatures above 30C. The introduced tropical C. hookeri and native L. annulata may be regarded as freshwater red algae types adapted to different temperature habitats. Dark carbon fixation in these species does not exceed 1% of the photosynthetic fixation potential, contributing significantly less to the total carbon balance than representatives of Phaeophyceae. (Danovich-Wisconsin)
W80-01366

NITRATE UPTAKE BY LAMINARIA LONGICRURIS (PHAEOPHYCEAE),
Rhode Island Univ., Kingston. Dept. of Botany.
M. M. Harlin, and J. S. Craigie.
Journal of Phycology, Vol 14, No 4, p 464-467, December 1978. 6 Tab, 11 Ref.

Descriptors: *Nitrate, *Phaeophyta, *Nutrient requirements, *Kelps, Aquatic algae, Algae, Nutrient kinetics, Nitrite, Nutrients, Temperature, Light, Plant physiology, Biochemistry, Ammonia, Canada, St. Margaret's Bay, Nova Scotia.

Laminaria longicruris, collected in St. Margaret's Bay, Nova Scotia, Canada, July-August 1974 and February 1978, accumulates nitrate under winter conditions thus supplementing internal N reserve

and sustaining growth after nitrate sea water concentrations have declined to low summer levels. This investigation of nitrate uptake from the water column by Laminaria looked at effects of nutrient concentrations, light levels, and temperatures within the range normally encountered. Nitrate uptake summer rates decline with decreasing temperature, but even at 0C, the rate is 30% of the 15C rate, 6.4 micromol h gDw. Laminaria scavenges nitrate from solutions with 0.5 micro M. The winter adapted tissues uptake rate in light at 0 C is 2.0 micromol h G Dw, almost 50% of that measured at 10C. Rates measured in darkness preceeded by light period are similar to control rates (1.9 micromol h g Dw at 0C), but if tissue is in darkness for 15 h the uptake rates but does not abolish them. Nitrate uptake is not suppressed by ammonia, even when the latter is present at 100 micro M for six h. Laminaria pretreated with antibiotics for five to 12 h are 97% and 88%, respectively, of the control nitrate uptake rates in light at 15C. Increasing the ratio of nitrate: nitrite causes increasing supression of nitrite uptake. (Danovich-Wisconsin)
W80-01367

VERTICAL AND SEASONAL VARIATION OF PHTOPLANKTON PHOTOSYNTHESIS IN A BROWN-WATER LAKE WITH WINTER ICE COVER,
Helsinki Univ. (Finland). Dept. of Botany.
R. I. Jones, and V. Ilmavirta.
Freshwater Biology, Vol 8, No 6, p 561-572, December 1978. 5 Fig, 2 Tab, 33 Ref.

Descriptors: *Phytoplankton, *Lakes, *Photosynthesis, *Succession, *Lake Paajarvi, Finland, On-site tests, Ice cover, Iced lakes, Light, Temperature, Biological communities, Plankton, Distribution, Seasonal, Environmental effects, Primary productivity, Adaptation, Ecological distribution.

Within limits imposed by prevailing environmental conditions, the amount of phytoplankton present in Lake Paajarvi, southern Finland, May 1976-May 1977, is the most important determinant of absolute photosynthetic rates. Photosynthetic capacity differences, whether due to adaptation of species composition alterations, are only of secondary importance. Lake Paajarvi, with 14.4 mean depth, is ice covered 140 d yr, has high dissolved organic content of 50 mg Pt l, and eutrophic zone restricted to the upper most 4 m. Phytoplankton do not show great adaptation to changing irradiance. Maximization of photosynthetic production is achieved by altering phytoplankton community composition, so that a steady algal species succession is observed through the year each one adapted to prevailing conditions. The chlorophyll content per unit algal volume does fluctuate, being lowest in summer (1-2.5 mg chl-a cu m) and highest after the long period of ice cover (5.5-7.2 mg chl-a cu m). The absence of a marked vertical photosynthetic capacity differentiation is attributed to the steep light gradient. Deep-water algae show photosynthetic rates per unit chlorophyll-a equivalent to or greater than those of upper-water algae, implying high algal sedimentation rates and low residence time. (Danovich-Wisconsin).
W80-01368

GROWTH RESPONSE OF ANABAENA FLOS-AQUAE (LYNGB.) DEBREBISSON IN WATERS COLLECTED FROM LONG LAE RESERVOIR, WASHINGTON,
Corvallis Environmental Research Lab., OR.
T. Shiroyama, W. E. Miller, and J. C. Shigihara.
In: Proceedings: Symposium on Terrestial and Aquatic Ecological Studies of the Northwest; March 26-27, 1976. Eastern Washington State College Press, Cheney, Washington. p 267-275. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Algal assay bottle test, *Cyanophyta, *Zinc, *Eutrophication, *Mine wastes, *Growth rates, Bioassay, Analytical techniques, A. flos-aquae, Long Lake(WA), Spokane(WA), Spokane River(WA), Seasonal, Coeur d' Alene River(WA), Phosphorus, Industrial wastes, Leaching, Impoundments, Laboratory tests, Washington, Anabaena.

In a laboratory investigation utilizing the standard algal assay bottle test, growth variations of the filamentous nitrogen-fixing blue-green alga Anabaena flow-aquae taken from eutrophic Long Lake, Washington were shown to result from zinc toxicity from smelter waste discharge and leaching of old mine tailings upstream in the Spokane - Coeur d' Alene River system. The lake, an impoundment of the river, has undergone water quality deterioration both from effluents of Spokane's municipal primary sewage treatment plant and from about 80 years of heavy metal inflow through the basin system. The cyanophyte failed to grow in unchelated water samples taken May 12-July 1 and in November, possibly a result of seasonal high flow of the Spokane River accompanied by high metal concentrations. Samples collected July 15-August 12 produced significant algal growth. During this period, phosphorus was determined as limiting. Heavy metals other than zinc may have been responsible for significant biomass drops in samples collected August 25-September 10 and September 23-October 21. Addition of EDTA to all water samples promoted a universal increase in biomass production, an in most samples raised A. flos-aquae growth to predicted levels as determined by phosphorus analysis. (Harris-Wisconsin)
W80-01369

USE OF ALGAL ASSAYS TO ASSESS THE EFFECTS OF MUNICIPAL AND SMELTER WASTES UPON PHYTOPLANKTON PRODUCTION,
Corvallis Environmental Research Lab., OR.
J. C. Greeene, W. E. Miller, T. Shiroyama, R. A. Soltero, and K. Putman.
In: Proceedings: Symposium on Terrestial and Aquatic Ecological Studies of the Northwest; March 26-27, 1976. Eastern Washington State College Press, Cheney, Washington, p 327-336. 5 Fig, 1 Tab, 11 Ref.

Descriptors: *Algal assay bottle test, *Municipal wastes, *Zinc, *Phytoplankton, *Toxicity, *Mine wastes, Bioassay, Analytical techniques, Waste water treatment, Standing crops, Eutrophication, Biomass, S. Capricornutum, Long Lake(WA), Spokane(WA), Spokane River(WA), Lake Coeur d' Alene(WA), Phosphorus, Nitrogen, Cycling nutrients, Industrial wastes, Leaching, Impoundments, Laboratory tests, Washington, Idaho.

The standard algal assay bottle test shows the indigenous phytoplankton standing crop in Long Lake, Washington is not affected by zinc carried in by the Spokane River from smelter waste discharges and leaching of old mine tailings in the upper reaches of the Lake Coeur d' Alene drainage basin. However, test results to show the standing crop (S. capricornutum) is limited by phosphorus and nitrogen affected mainly by effluent from Spokane's municipal primary sewage treatment plant, comprising about 0.4% of the river's flow below the discharge point. The lake, an impoundment of the river, has undergone water quality deterioration, but approximately 80 years of heavy metal inflow throughout the basin system has probably affected species composition if not productivity. Each Long lake test station was sampled individually. Water samples were collected from the surface to the lower limit of the euphotic zone, usually at 1-2 m intervals. Zinc was analyzed on an atomic absorption spectrophotometer; lake waters without nutrient or chelator additions served as controls. The assay revealed that Long Lake is primarily nitrogen-limited for phytoplankton growth in 57% of the samples. Phosphorus was limiting in 30% of the samples and either nutrient in 13%. (Harris-Wisconsin)
W80-01370

THE DIATOMS OF CONTEMPORARY AND ANCIENT SEDIMENTS FROM LAKE WAIAU, AND THEIR GEOCHEMICAL ENVIRONMENT,
Hawaii Univ., Honolulu. Dept. of Botany.
J. E. Massey.
Review of Paleobotany and Palynology, Vol 27, No 1, p 77-83, 1979. 2 Fig, 2 Tab, 10 Ref.

Descriptors: *Diatoms, *Lake Maiau(HA), *Sediments, *Cores, *Paleolimnology, *Geochemistry, Population, Speciation, Hawaii, Sampling, Geologic time, Ecology, Quaternary period, Regression analysis, Equations, Soil chemistry, Chemical analysi.

Eight diatom species occur in core sediments taken from Lake Waiau, Hawaii: Nitzchia frustulum, Nitzschia vitrea, Achnanthes hauckiana, Navicula radiosa, Hantzchia amphioxys Cocconeis placentula, Melosira italica, and a new specis, Stauroneis maunakeaensis. Lake Waiau, a heart-shaped water body with one ha area and three m maximum depth, is located at 3969 m on Mauna Kea, an extinct volcano. Bottom sediments cores contain diatom frustules spanning a 5000 yr period. All ancient diatom species, except Stauroneis, are heteromorphic, cosmopolitan forms. The two Nitzschia species are found throughout the two m core. H. amphioxys and C. placentula aren't found throughout contemporary sediments; however, five additional species are present: Navicula divergens, Amphora costata, S. kriegeri, Fragilaria lapponica, and Rhopalodia musculus. Between 70-140 cm, marked fluctuations in N. frustulum populations occur; three other species also appear briefly. The most recent 38 cm layers reflect human influences. Comparing core and contemporary sediments, the following chemical changes are observed: increases in Mn and Ca concentrations, decreases in Na, K, P, Si, Al, Fe, and no changes in Mg and Ti contents. When potassium (Kx and aluminum levels rise, N. frustulum population declines; high K levels, 15 micro g-at/g sediment, alone produces this response. N. vitrea populations exhibit acute sensitivity to unusually high phosphorus concentrations (4.8 micro g-at/g sediment) reflecting phosphate effects on essential trace metal availability. (Danovich-Wisconsin)
W80-01371

RADON-222 IN POTABLE WATER SUPPLIES IN MAINE: THE GEOLOGY, HYDROLOGY, PHYSICS AND HEALTH EFFECTS,
Maine Univ. at Orono. Land and Water Resources Center.
C. T. Hess, S. A. Norton, W. F. Brutseart, R. E. Casparius, and E. G. Coombs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116304, Price codes: A07 in paper copy, A01 in microfiche. Completion Report, September, 1979. 119 p, 25 Fig, 19 Tab, 31 Ref, Append. OWRT A-045-ME(2).

Descriptors: *Gases, *Water pollution sources, *Groundwater, Domestic water, Maine, Potable water, Water supply, Water quality standards, Water analysis, *Radon-222, Health effects.

Objectives were: (1) to obtain up to 2000 samples of groundwater and to measure them using a new inexpensive liquid scintillation technique; (2) to collect 350 samples of water from drilled wells, private water supplies, and some public water supplies to determine their physical, chemical, and geological characteristics in order to describe the geographic distribution of areas of high radon; (3) to determine levels of radon gas in the environment of ten sample homes; to describe the type of housing and level of radon in their respective water supplies; (4) to prepare a map showing the distribution of sample points with radon levels; (5) to calculate the statistical association of radon with cancer; (6) to provide a scientific basis for setting a state drinking water standard for radon; and (7) to make recommendations for further study. Preliminary conclusions: (1) radon is present in much of Maine's water supplies in excessive amounts; (2) radon concentrations are highest in granite formations; (3) public utility water supplies have substantially lower radon levels than do private wells; (4) levels of radon gas in home air exceed recommended levels and result in a dose rate associated with high risk in industrial settings; (5) levels of radon are highly correlated with some types of cancer, especially of lung and reproductive systems; and (6) a domestic water supply standard of 10,000 pCi/1 is recommended to yield dose rates or mortality rates that would not exceed national averages.
W80-01378

COMMUNITY INTERDEPENDENCE AND ENVIRONMENTAL QUALITY: PROBLEMS IN MANAGING NON-POINT POLLUTION,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
For primary bibliographic entry see Field 6E.
W80-01380

ISOLATION OF PATHOGENIC NAEGLERIA FROM ARTIFICIALLY HEATED WATERS,
Oak Ridge National Lab., TN.
R. L. Tyndall, E. Willaert, A. R. Stevens, and C. C. Coutant.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-770961-3, Price codes: A02 in paper copy, A01 in microfiche. (1977) 2 Fig, 5 Tab, 13 Ref.

Descriptors: *Electric powerplants, *Heated water, *Water temperature, *Pathogenic bacteria, Florida, Texas, Tennessee, Thermal pollution, Temperature, Water cooling towers, Water pollution sources, Microorganisms, Environmental effects, Human pathology, Diseases, Effluents, Public health.

Artificially heated waters may facilitate propagation of pathogenic, free-living amoeba as shown from water samples collected in summer 1976 near power plant discharges in Florida and Texas and from cooling towers in Tennessee. Water temperatures range 25 to 41C. Waters receiving thermal discharge from electric power plants were studied to determine whether there is increased pathogenic free-living amoeba proliferation. Water samples were also taken from several lakes not associated with power plants; these water temperatures range 30 to 34C. Some water samples receiving power plant effluent show amoeba growth at 45C and some mice inoculated with amoeba isolates died within 4-10 days. The amoeba was identified as Naegleria due to their ability to grow at 45C, transform into flagellates, and produce primary amebic meningoencephalitis (PAME) in mice. The amoeba were confirmed as N. fowleri by antiserum tests. Two of five Florida power plant effluent sites are positive for N. fowleri whereas control lakes are devoid of the amoeba. Only one of 11 Texan sampling sites yielded pathogenic N. fowleri. Although Oak Ridge, Tennessee, cooling towers were negative for N. fowleri, amoeba identified as Acanthamoeba grew from all 37C samples. Pathogenic free-living amoeba in heated water poses public health problems in areas used for recreational purposes. (Danovich-Wisconsin).
W80-01390

WATER QUALITY AND URBAN STORMWATER: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 4C.
W80-01399

DISTRIBUTION OF INTERTIDAL DIATOMS ASSOCIATED WITH SEDIMENTS IN YAQUINA ESTUARY, OREGON,
Oregon State Univ., Corvallis, Dept. of Botany and Plant Pathology.
M. C. Amspoker, and C. D. McIntire.
Journal of Phycology, Vol 14, No 4, p 387-395, December 1978. 4 Fig, 5 Tab, 46 Ref. NSF DES 72-01412 A01.

Descriptors: *Diatoms, *Distribution, *Intertidal areas, *Salinity, *Sediments, *Mathematical studies, *Estuarine environment, *Yaquina Estuary, Newport(OR), Estuaries, Oregon, Distribution patterns, Environmental gradient, Numerical analysis, Correlation analysis, Light, Plankton, Brackish water, Freshwater, Sea water, Ecological distribution.

The paper presents quantitative and qualitative analysis of sediment-associated diatom assemblages along horizontal, vertical, and seasonal environmental gradients in Yaquina Estuary near Newport, Oregon, November 1973 to August 1974. Diatom distribution is regulated primarily by mean sediment size and salinity; however, half the diatom flora numerical variation was related to factors other than the measured physical and chemical parameters. Diatom flora is mostly continuous but in some cases it is patchy. At 5% mean salinity, a relatively sharp discontinuity occurs in the diatom flora which represents biochemical and biophysical mechanisms involved in osmotic regulation of fresh- and brackish water diatoms. Stochastic processes, biological interactions, such as grazing, amensalism, and competition for suitable substrata, and physiological tolerance of the fluctuating estuarine environment must influence population dynamics and community structure. The sediment-associated diatom flora are dissimilar in species composition to epilithic, epiphytic, and planktonic assemblages in Yaquina estuary. Approximately 36,500 diatom cells were identified representing 61 genera; the largest number belong to genera Navicula, Nitzschia, Achnanthes, Amphora, and Cocconeis. Species diversity is high while redundancy is low. There is no conspicuous distributional pattern associated with season or intertidal height. (Danovich-Wisconsin)
W80-01436

SEDIMENTS OF LAKE ROTORUA AS SOURCES AND SINKS FOR PLANT NUTRIENTS,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
E. White, B. J. Don, M. T. Downes, L. J. Kemp, and A. L. MacKenzie.
New Zealand Journal of Marine and Freshwater research, Vol 12, No 2, p 121-130, June 1978. 5 Fig, 7 Tab, 16 Ref.

Descriptors: *Cycling nutrients, *Anaerobic conditions, *Lake sediments, *Nutrient loading, *Chemical analysis, Sediments, Sediment-water interfaces, Phosphorus, Lakes, Nitrogen, Water pollution sources, Eutrophication, New Zealand, Nutrients, Nutrient budgets.

Nutrients released from anoxic sediments in Lake Rotorua, New Zealand, were estimated at 20-40 mg P.sq m/d and 250-350 mg N sq m/d; however, deoxygenation was slight compared with 1969-1970 and 1974-1975. If reducing conditions affected 60% of the lake bottom over 13 days, the released nutrients would amount to 25-50% of those added annually from other sources. Quantitative estimates were made of nutrients released from the sediments in order to compare them directly with other nutrient sources. Lake Rotorua, with a mean depth of 10.7 m and an 81 sq km area is a eutrophic lake with a chlorophyll a content of 4.5-47.0 mg/cu m. The Rotorua urban area has a 47,000 population. In 1973 a new activated sludge sewage treatment plant replaced septic tank systems. The phosphorus level in 1975 increased to 47 kg/d from the 1960 level of 12 kg/d and the nitrogen level in 1975 increased to 290 kg/d from the 1960 level of 75 kg/d. In mid-January 1976 calm weather produced anaerobic conditions for six days. The reduced sediment condition produced a spectacular increase in mean nutrient concentrations. The dissolved reactive phosphorus was 4.0 mg/cu m and inorganic nitrogen was 50 mg/cu m corresponding to and increase of 3100 kg phosphorus and 39,000 kg ammonia-nitrogen. (Danovich-Wisconsin)
W80-01441

NITROGEN AS A GROWTH FACTOR IN FRESHWATER,
National Swedish Environment Protection Board, Uppsala. Inst. of Physiological Botany.
C. Forsberg.
Progress in Water Technology, Vol 8, No 4-5, p 275-290, 1977. 3 Fig 1 Tab, 99 Ref.

Descriptors: *Nitrogen, *Freshwater, *Plant growth, *Trophic level, *Phytoplankton, *Limiting factors, Algae, Aquatic plants, Eutrophication, Oligotrophy, Mesotrophy, Organic compounds, Inorganic compounds, Waste water treatment, Nutrient removal, Ammonium, Nitrates, Vitamins, Ultra-oligotrophy, Absorption, Nutrients.

A survey of the role of nitrogen in freshwater plant growth, emphasizing phytoplankton, indicates that in strongly eutrophic waters resulting from sewage pollution, nitrogen is a more important growth-limiting nutrient than phosphorus. In less eutrophic and mesotrophic waters the two nutrients exert about equal control, while in oligotrophi lakes phosphorus is often dominant. Examples are presented, however, in which nitrogen is a limiting nutrient in ultra-oligotrophic lakes. Nitrogen concentrations in natural waters vary from very low values to several mg/l. Ammonium and nitrate are most often preferred by water plants, but such organic compounds as amino acids, amides, urea, and uric acid are also suitable nitrogen sources. As a vitamin constituent, nitrogen is a factor in the growth of auxotrophic organisms, and as a constituent or organic compounds with chelating capacity, it can indirectly support their growth. Nitrogen content in aquatic plants ranges 1-10% of dry matter. Luxury uptake of nitrogen or phosphorus causes large variations in the N:P ratio. Analyses of tissues to estimate minimum nutrient content necessary for growth indicate a critical N:P ratio of 10:1. Additional research needs are also described. (Lynch-Wisconsin)
W80-01442

PHYTOPLANKTON COMMUNITIES IN UPWELLING AREAS. THE EXAMPLE OF NW AFRICA,
Barcelona Univ. (Spain). Dept. of Ecologia.
R. Margaelf.
Oecologia Aquatica, No 3, p 97-132, July 1978. 15 Fig, 12 Tab, 53 Ref.

Descriptors: *Phytoplankton, *Upwelling, *Distribution patterns, *Atlantic Ocean, Distribution, Biological communities, Circulation, Movement, Population, Dinoflagellates, Nutrients, Adaptation, Hydrodynamics, Light, Light intensity, Flow currents(Water), Mixing, Turbulence.

Data from late summer 1971 and spring 1975 cruises off northwest Africa show that phytoplankton community population sequences, representing ecological succession, develop around a core of maximum water movement. Diatoms are the most important characteristic upwelling organisms and primary production is maximal in central upwelling areas, however, production is also important in peripheric areas with large diatoms. Thalassiosira and Phaeocystis speices located close to upwelling core areas are often covered by mucilage. Around the core species, populations involve diatoms such as Nitzchia, Chaetoceros, and Rhizosolenia, of rather large individual cell size. Water speed, nutrient concentration, and light use and penetration are decisive in establishing definite distribution layers. Hydrodynamics, which explains funnelling and energy concentration in particular spots and how water movement breaks down into cells, is essential in understanding phytoplankton distribution patterns. In spring, upwelling intensification blows apart the whole structure; large diatom populations adopt peripheric or concentric positions in relation to maximum nutrient outflow. Dinoflagellates develop in large numbers in moderate upwelling areas, but populations disperse in stronger flow seasons. Thermic conditions affect Hemicaulus, Asterinonella glacialis, and Amphora hyalina diatom distributions, but mechanical factors and associated nutrient inflow determine entire distribution patterns. (Danovich-Wisconsin)
W80-01443

DISTRIBUTION OF PHYTOPLANKTON IN ARKANSAS LAKES,
Nevada Univ., Las Vegas. Dept. of Biological Sciences.
J. W. Holgert, F. A. Morris, M. K. Morris, W. D. Taylor, and L. R. Williams.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-292742, Price codes: A04 in paper copy, A01 in microfiche. EPA-600/3-78-101, December 1978. 53 p, 3 Tab, 12 Ref, 2 Append.

Descriptors: *Distribution, *Arkansas, *Lakes, *Phytoplankton, *Systematics, *Baseline studies, Eutrophication, Water quality, Trophic level, Speciation, Computers, Bioindicators, Indicators, Water polltuion, Organic loading, Sewate ef-

fluents, Organic waters, Sewage, Data storage and retrieval, Data processing.

This report presents a computerized inventory of phytoplankton species aand abundance in 16 Arkansas lakes and results of several biological indices of water quality and community structure during 1974. Data biologically characterizes the lakes and will be used as baselines for future investigations. Sampling was part of a National Eutrophication Survey and was limited to lakes impacted by municipal sewage treatment plant outfalls, 40 ha or larger in size, and mean retention time at least 30 days. Lakes are sampled under spring, summer, and fall conditions. Nygaard's Trophic State, Palmer's organic Pollution and species diversity and abundance indices are also included. Dominant phytoplankton in Beaver Lake are Chroomonas acuta and Melosira diatoms. Nygaard's index shows the lake is eutrophic and Palmer indicates high organic loads in August whereas April and October loads are low. Chroomonas acuta, Melosira distans and Skeletonema potamos are dominant in Lake Catherine. Crytomonas erosa and Melosira distans are domninat in Lake Chicot. The lake is eutrophic and high organic pollution occurs in August; organic pollution loads are low in March and October. Grand Lake is eutrophic and has an extremely high organic pollution head during the entire year; dominant phytoplankton include Stephanodiscus astrea v. minutala and Dactylococcopis. (Danovich-Wisconsin)
W80-01444

THE EFFECTS OF BRIEF PERIODIC SUBMERGENCE OF INTERTIDAL FUCOID ALGAE,
Glasgow Univ., (Scotland). Dept. of Botany.
M. Schonbeck, and T. A. Norton.
Estuarine and Coastal Marine Science, Vol 8, No 3, p 205-211, April 1979. 4 Tab, 11 Ref.

Descriptors: *Intertidal areas, *Nutrients, *Algae, *Phaeophyta, Ecology, Scotland, Coasts, Growth rates, Tides, hajbitats, Productivity, Nutrient requirements, Light, Drying, Niches, Water level fluctuations, Algal growth potential, Water levels, Marine algae.

In 1975 in-situ and culture experiments of three intertidal algal species taken from the Isle of Cumbrae, Scotland, Fucus spiralis and Pelvetia canaliculata differed from the lower shore Fucus serrarus in that they only grew quite rapidly when submerged for only short periods. The paper investigates the possibility that nutrient scarcity, dissolved inorganic carbon, or aerial conditions control inter-tidal seaweed upper limits. Samples were collected in summer and winter, 1975. The linear growth of F. spiralis in-situ plants changed from 22.1 mm mo to 10.5 mm mo towards the top of their usual habitat zone and P. canaliculata plants grew 4.9 mm mo at the same height as compared to their maximum rate of 7.1 mm mo. Reduced winter growth reflects very low solar irradiance conditions. All plants grow under simulated tidal regimes and P. canaliculata and F. Spiralis grows almost as rapidly in length and weight when submerged only one hr per 12 as they dor for 11 hr. F. serratus grows progressivley faster with increasing submersion time at rate of 12.5 mm mo and 23.2 mm mo for one hr and 11 hr cycles, respectively. F. spiralis and P. canaliculata grow slowely when submerged only four hr cycles, respectively. F. spiralis and P. canaliculata grow slowly when submerged 20 hr d. P. canaliculata and F. spiralis also grow very slowly when submerged only four hr d in dilute nutrient medium, but growth increases in full nutrient culture medium. Both species require lower nutrient concentrations when submerged 20 hr d. P. canaliculata and F. spiralis also grow very slowly when exposed to air during the light period, and more rapidly when sumberged during the light period. (Danovich-Wisconsin)
W80-01445

NITROGEN AS LIMITING FACTOR FOR THE GROWTH OF THE BLUE-GREEN ALGA OSCILLATORIA AGARDHII,
Amsterdam Univ. (Netherlands). Lab. for Microbiology.
L. Van Liere, W. Zavenboom, and L. R. Mur.
Progress in Water Technology, No 4-5, Vol 8, p 301-312, 1977. 7 Fig, 2 Tab, 30 Ref.

Descriptors: *Nitrogen, *Cyanophyta, *Growth rates, *Nutrient kinetics, *Pigments, Oscillatoria agardhii, Gomont, Limiting factor, Physiological ecology, Laboratory tests, Chlorophyll, Algae, Biochemistry.

Growth of the Cyanophyte Oscillatoria agardhii followed Menten-Michaelis kinetics under limited nitrate supply in laboratory tests, and there were large differences between batch-growth and continuous-culture specimens for both measured parameters: specific growth rate constant and half-saturation constant. At higher light intensities chlorophyll-a and C-phycocyanin were lowered, but total carotenoid content did not change. A decrease of chlorophyll-a and C-phycocyanin during the cessation of growth indicates these pigments may function as a nitrogen reserve in the growth processes after nitrogen depletion. Growth rate and incident light intensity both influenced pigmentation of the alga. Nitrogen-starved cells or batch cultures and nitrogen limited chemostat cultures were used to study the influence of nitrogen on organism growth. Determination of the half-saturation constant and the maximum value of the specific growth rate constant in chemostats, with organisms that are adapted to low limiting concentrations are considered the best way to understand the role of nutrient concentrations. (Danovich-Wisconsin)
W80-01446

NITROGEN FIXATION-A REVIEW OF THIS PHENOMENON AS A POLLUTING PROCESS,
Californai Univ., Berkeley. Sanitary Engineering Research Lab.
A. J. Horne.
Progress in Water Technology, Vol 8, No 4-5, p 359-372, 1977. 1 Tab, 53 Ref.

Descriptors: *Nitrogen fixation, *Water pollution, *Eutrophication, *Cyanophyta, *Pollution abatement, *Chemical control, Nitrogen, Watersheds, Metabolism, Nuisance algae, Trophic level, Aquatic productivity, Nitrogen cycle, Lakes, Clear Lake(CA), Southern Basin, Windermere, United Kingdom, Lentic environment, Estuaries, Salt marshes, Homeostasis, Oligotrophy, Mesotrophy, United Kingdom.

Nitrogen fixation can sometimes but not always supply all the nitrogen for eutrophication if phosphorus is supplied. Nitrogen fixation is part of the polluting process under two conditions: (1) original rates are increased by addition of other substances such as phosphorus, iron, erosion, or sewage, and natural rates change the water body from oligo- or mesotrophic to a eutrophic condition; (2) if nitrogen fixation maintains a highly eutrophic state. This literature study focuses on measurements of nitrogen fixation over several years in water bodies and recommends use of chemical compounds that effect blue-green algal metabolism. Nitrogen fixation causte 30-50% of this lakes annual nitrogen income whereas sediment bacterial nitrogen fixation is low. At the southern Basin of Windermere, U.K. nitrogen fixation is important to nitrogen income of individual algal but not to the whole lake nitrogen inflow. The role of nitrogen fixation is not important in river environments except when a river flows into nitrogen-depleted reservoirs or lakes. Values of nitrogen fixation in open estuarine waters or salt marshes are not yet available. Copper is suggested as an economical and ecologically safe chemical to attack blue-green algae nitrogen fixation and copper is less toxic at higher trophic levels. Iron and aeration to reduce soluble iron also limits nitrogen fixation. (Danovich-Wisconsin)
W80-01447

DIEL VARIATION OF NITROGEN FIXATION BY A MARINE BLUE-GREEN ALGA, TRICHODESMIUM THIEBAUTII,
Tokyo Univ. (Japan). Ocean Research Inst.
T. Saino, and A. Hattori.
Deep-Sea Research, Vol 25, No 12, p 1259-1263, December 1978. 1 Fig, 1 Tab, 23 Ref.

Descriptors: *Cyanophyta, *Marine algae, *Nitrogen fixation, *Diurnal, Algae, Cycling nutrients, Biorhythms, Phytoplankton, Nutrient requirements, Pacific Ocean, Plant physiology, Metabolism, Bioassay, Ammonium compounds, Shikoku Island, Japan.

Study of diel variations in the nitrogen-fixing capacity of a natural population of Trichodesmium thiebautii, about 100 miles south of Shikoku Island, Japan reveals that this blue-green alga plays a central role in the nitrogen budget of low latitude seas. T. thiebautii colonies were collected from the surface at 2-3 h intervals March 8, 1977, and their acetylene reduction and ammoninum uptake were assayed immediately. Nitrogen fixation (acetylene reduction) increased after sunrise, attained maximum by noon, and declined in the afternoon. The midday activity, 60 mmole ethylene micro g chl-a h, was about 200 times the night value. This activity is the highest ever reported for marine blue-green algae and is similar to values obtained with cultured heterocystous blue-green algae. C:N ratios ranged 5.8-6.0 at daytime to 5.5-5.6 at night. Ammonium uptake hardly showed diel variation. (Danovich-Wisconsin)
W80-01448

PHOSPHATASE ACTIVITY IN EUTROPHIC TOKYO BAY,
Tokyo Univ. (Japan). Ocean Research Inst.
N. Taga, and H. Kobori.
Marine Biology, Vol 49, No 3, p 223-229, 1978. 7 Fig, 1 Tab, 23 Ref.

Descriptors: *Tokyo Bay, Japan, *Distribution, *Phosphates, *Enzymes, *Bacteria, Phosphorus, Indicators, Eutrophication, Distribution patterns, Chlorophyll, Bays, Ecological distribution, Proteins, Biochemistry, Analytical techniques, Spectrophotometry, Fluorometry, Marine bacteria.

Alkaline phosphatase activity in Tokyo Bay, Japan, July 1971 to August 1973, significantly correlates with other biological parameters such as chlorophyll and total phosphorus (TP) content, suggesting the enzyme is a good indicator of eutrophication. The enzyme shows a satisfied pattern in August and a vertically mixed pattern in December, reflecting changes in physical seawater conditions such as water temperature and salinity. Phosphatase activity in August (200 ng-at/l/h) is five times higher than in December (40 ng-at/l/h). Phosphatase activity decreases in deeper waters and also closer to the bay's mouth. Viable phosphate-producing bacteria number 100,000/ml in inner bay areas, 1000-fold higher than in the bay's mouth. Mean chlorophyll-a content in inner bay areas is 498 micro g/l, 300-fold higher than in the bay's mouth. Phosphatase activity distribution in eutrophic seawater correlates with viable bacteria counts, chlorophyll-a content, inorganic and TP concentrations, seston amounts, particulate deoxyribonucleic acids (DNA) and protein. The enzyme reflects bacterial population which in turn closely relates to TP and trophic levels. Microorganism phosphates production is not repressed at inorganic phosphorus levels (six micro g-at P/l) in the bay because bay levels are low, P turnover rate is rapid and 25% of the bacteria are constitutive phosphatase producers. (Danovich-Wisconsin)
W80-01451

THE KINETICS OF PHOSPHATE REMOVAL IN SMALL ALKALINE LAKES BY NATURAL AND ARTIFICIAL PROCESSES,
Northwestern Univ., Evanston, IL.
For primary bibliographic entry see Field 5G.
W80-01452

ASSIMILATION OF PARTICULATE ORGANIC CARBON BY ESTUARINE AND COASTAL COPEPODS,
City Univ. of New York.
M. B. Chervin.
Marine Biology, Vol 49, No 3, p 265-275, 1978. 7 Fig, 3 Tab, 36 Ref. NOAA 03-4-043-310, 04-5-022-

22.

Descriptors: *Copepods, *Detritus, *Phytoplankton, *Hudson River(NY), *New York Bight, Metabolism, Temperature, Animal physiology, Coasts, Estuaries, Estuarine environment, Diets, Nutrient requirements, Correlation analysis, Regression analysis, Mathematical studies, Respiration.

Copepod particulate organic carbon assimilation rates in the lower Hudson River Estuary and apex of the New York Bight April 1975 to March 1976 are associated with variation in body weight, temperature, and quantity and quality of food available. The New York Bight has low particulate organic carbon (POC) concentrations (less than 0.84 mg/l) and is mostly phytoplankton; assimilation rates correlate positively with POC concentrations. Hudson Estuary has high POC concentrations (greater than 0.73 mg/l) and is mostly from sewage; assimilation rates correlate negatively with POC concentrations. Assimilation rates are affected negatively by detritus quantities greater than 0.5 mg/l; at lower detritus concentrations, utilization rates (ratio of POC assimilated to POC available) increase to values ranging 4 to 10. Daily assimilation rates in both areas vary between 2.7% and 15% of copepod body weight with most values between 10% and 50%. Higher coastal respiratory rates are a function of greater detritus utilization. Estuarine elevtivity index shows a preference for living material and against detritus while coastal values indicate selection for detritus and against living material. Detritus forms between 26% and 44% of copepod diets in the estuary compared with 31% to 81% in the apex. Net growth efficiencies range from 9% to 76% and are inversely proportional to detritus percentage in diets, suggesting that detritus is inferior to phytoplankton as a food source. (Danovich-Wisconsin)
W80-01453

NITROGEN AND PHOSPHORUS IN LAKE ONTARIO TRIBUTARY WATERS,
Edgewood Arsenal, MD.
W. F. Cowen, K. Sirisinha, and G. F. Lee.
Water, Air and Soil Pollution, Vol 10, No 3, p 343-350, October 1978. 1 Fig, 5 Tab, 12 Ref. EPA R-800537.

Descriptors: *Rivers, *New York, *Nitrogen, *Phosphorus, *Chemical analysis, Lake Ontario, Nutrients, Nutrient budgets, Nutrient loading, Water chemistry, Testing, Testing procedures, Laboratory tests, Equations, Nitrogen compounds, Phosphorus compounds, Bioassay, Analytical techniques.

A nutrient availability study of organic nitrogen (ON) and particulate phosphorus (PP) forms in New York tributaries to Lake Ontario concludes that available nitrogen is estimated by NH3-N plus (NO3-N - NO2-N) plus 0.5 (TKN - NH3-N). Total phosphorus (TP) availability is estimated by adding soluble orthophosphorus (DRP) to 0.2 (TP-DRP), where DRP is approximately equal to TSP, so (TP-DRP) represents PP. The 0.2 and 0.5 factors governing availability of ON and PP, respectively, are guidelines and are highly variable, both spatially and temporally. Samples from Niagara, Genesee, Oswego, and Black Rivers were collected August 1972 to June 1973. Average total nitrogen (TN) availability in aerobic mineralization tests varies 62% to 78% of TN. Ammonia levels are generally negligible and nitrate levels are constant after 25 incubation days. ON availability results vary greatly (29% to 60%) in river samples. Average TP percentage estimated as available by chloroform treatment is greater than initial values in all rivers except the Genesee, which carries large suspended soil particle loads which absorb released phosphate. Dark incubations are variable. Algal bioassay results for all other rivers generally agrees with mineralizations and chloroform results, indicating 30% to 67% TP availability. Resin, base, and algal bioassay values for PP availability show an overall 0 to 34% range of PP extracted. (Danovich-Wisconsin)
W80-01454

PREDICTION OF ALGAL-AVAILABLE PHOSPHORUS IN RUNOFF SUSPENSIONS,
Wisconsin Univ.-Madison. Dept. of Soil Sciences.
P. J. Huettl, R. C. Wendt, and R. B. Corey.
Journal of Environmental Quality, Vol 8, No 1, p 130-132, 1979. 2 Fig, 2 Tab, 11 Ref. Hatch No 1722.

Descriptors: *Phosphorus, *Analytical techniques, *Bioassay, *Chemical analysis, *Resins, *Agricultural runoff, Nutrients, Testing, Runoff, Testing procedures, Laboratory tests, Regression analysis, Phosphorus compounds, Ion exchange, Sediment load, Suspended load, Suspended solids, Fertilizers, Water pollution sources.

Use of hydroxy-Al resin for estimating potentially available phosphorus (P) in agricultural runoff suspensions shows promise as a routine method; almost as much P (98%) is removed by resin as is removed by algae in water systems. In both cases P removed is 20% to 40% of total inorganic P. Available P in natural systems depends upon sediment amounts delivered to a water body, suspension time in the photic zone, temperature, pH, light intensity, algal species, and population, and other essential nutrient available. Therefore, bioassay measurements only serve as relative algal-available P estimates. Equilibrations of prepared resin with 20 micro m soil fractions of five soil types were performed at 1,000:1 solution soil ratios. About 75% of the total P extracted is removed in the initial 24 h equilibrium. Extraction patterns show decreasing P removal rates by resin with time. Similarly, greater P uptake by algae is observed in the first 24 h incubation period than in the second. Correlations between resin-extractable P and algal-available P are significant ($r=0.98$, $n=5$). However, available P amounts differ, particularly at low levels, depending on whether PAAP nutrients minus P and micronutrients or water is used as a medium. (Danovich-Wisconsin)
W80-01455

THE WATER HYACINTH: FROM PROLIFIC PEST TO POTENTIAL PROVIDER,
National Space Technology Labs., NSTL Station, MS.
For primary bibliographic entry see Field 4A.
W80-01457

THE SEEDING OF TWO RED TIDE BLOOMS BY THE GERNINATION OF BENTHIC GONYAULAX TAMARENSIS HYPNOCYSTS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
D. M. Anderson, and F. M. M. Morel.
Estuarine and Coastal Marine Science, Vol 8, No 3, p 279-293, 1979. 5 Fig, 1 Tab, 33 Ref.

Descriptors: *Cape Cod, Massachusetts, *Red tide, *Water temperature, *Dinoflagellates, *Germination, Trace elements, Shellfish, Toxicity, Water pollution, Dormancy, Eutrophication, Salinity, Microorganism, Metabolism, Animal physiology, Estuaries, Spores, Benthos, Protozoa.

Data on nutrients, salinity, temperature and rainfall indicate that temperature induces spring germination of overwintering benthic hypnocysts among Gonyaulax tamarensis blooms, monitored on Cape Cod, Massachusetts salt ponds spring and fall 1977. This study focuses on basic mechanisms underlying erratic toxic dinoflagellate outbreaks which cause shellfish poisoning along the New England and eastern Canadian coastline. Water temperatures of the bottom 2.5 m in Perch Pond increase from four C on March 20 to 17.2C on April 22. Beginning in late March, motile G. tamarensis cells are present in Perch Pond and reach 60,000 cells/ml on April 22 before disappearing in mid-May. Reasons for bloom decline are unknown; motile populations may be transformed into new hypnocysts which settle into sediments. During the same spring period, G. tamarensis is not detected at nearby Great Pond until mid-April; samples from Vinyard Sound, nine km away, do not contain G. tamarensis during the study period. Extreme bloom localization is due to limited tidal advection of the motile population and favorable estuarine trace metal chemistry compared to adjacent coastal areas. Fall bloom is also seeded by hypnocysts germination with excystment initiated by temperature decreases from summer 20-22C levels. The temperature conditioning mechanism does not require overwintering; prolonged high temperatures will suffice. (Danovich-Wisconsin)
W80-01458

NITROGEN POOLS IN GEORGIA COASTAL WATERS,
Georgia Univ., Sapelo Island. Marine Inst.
E. B. Haines.
Estuaries, Vol 2, No 1, p 34-39, March 1979. 3 Fig, 2 Tab, 24 Ref. NSF-DES 75-20842.

Descriptors: *Nitrogen, *Coastal marshes, *Tidal effects, *Nutrient transport, *Cycling nutrients, Georgia, Coasts, Tides, Sapelo Island(GA), Salt marshes, Inorganic compounds, Organic compounds, Nutrients, Nitrogen cycle, Nitrates, Nitrites, Ammonia, Nitrogen compounds.

The high concentration of dissolved organic nitrogen (DON) ranging 4.4-38.0 micro g at N/l, on the ebb tide and high PN concentrations, ranging 13.0-239.0 micro g at N/l, on the flood tide, suggests a net import of PN and an export of DON in a salt marsh near Georgia shelf waters. This paper discusses distribution of dissolved and particulate forms of nitrogen in inshore and nearshore waters of the Georgia coast, where extensive salt marsh estuaries are dominated by tidal flushing. Surface water samples were taken at 21 stations off the Georgia coast between two and 10 km offshore and at four stations within the mouths of Doboy and Sapelo Sounds in February, May, August, and November, 1975. The surface offshore waters were mixed to the extent that no discernable seasonal distribution pattern of the various nitrogen forms was apparent. Concentrations of inorganic nutrients, ammonia, nitrite and nitrate were fairly low, ranging from 0.0-2.2 micro g at N/l. The extremely low nitrogen concentrations measured in Georgia coastal waters at all times of the year indicates that the nitrogen distribution is dominated by internal cycling rather than by large nitrogen forms, ranging 0.0-0.9 micro g at N/l at high tide, were observed in the four nearshore stations. High concentrations of ammonia, up to 73.4 micro g at N/l, were measured in nearshore low tide water indicating a high ammonia content of the marsh soils. (Danovich-Wisconsin)
W80-01459

HORIZONTAL UNDEPENDABILITY IN THE PLANKTONIC ENVIRONMENT,
Scripps Institution of Oceanography, La Jolla, CA.
J. L. Star, and M. M. Mullin.
Marine Science Communications, Vol 5, No 1, p 31-46, 1979. 3 Fig, 2 Tab, 20 Ref.

Descriptors: *Spectroscopy, *Temperature, *Chlorophyll, *Plankton, Pacific Coast region, Pacific Ocean, Fluorometry, Phytoplankton, Depth, Food abundance, Coasts, Foods, Ecosystems, Analytical techniques, Food chains.

Cross-sectional computations show no coherence between chlorophyll and temperature measurements taken from horizontal transects at a 30-39 m depth in two areas of the Pacific Ocean, indicating an environment which is physically and nutritionally undependable. This paper explores dependability of the environment, by variables of temperature and chlorophyll, experienced by some marine planktonic herbivores in order to explain their adaptations in different regimes. Variations in temperature were used to reflect change in physical environment, and chlorophyll was used as an index of food availability. Horizontal transects were taken of the North Pacific Central Gyre and the nearshore region off southern California in July 1977. Continuous chlorophyll samples were recorded from fluormeter effluent and integrated samples along the transect. Near Central Gyre stations, there is a large, negative vertical gradient of temperature and a relatively smaller, positive chlorophyll gradient. The various spectra from both areas are similar and spectral analysis suggests a small and constant variability between wavelengths of 45 m and 600 m. Within the context of a

cross-spectral analysis, the food resource is not organized in relation to the physical environment. Even though the spatial scales of patchiness are similar on all transects, the nearshore environment is much more variable than the offshore. The highest chlorophyll concentrations in the Central Gyre are below the minimum found nearshore. (Danovich-Wisconsin)
W80-01460

FISHERIES IN LAKE RESTORATION,
Environmental Protection Agency, Washington, DC. Office of Water and Waste Management.
For primary bibliographic entry see Field 5G.
W80-01461

UPTAKE OF INORGANIC NITROGEN BY SODIUM FRAGILE SUBSP. TOMENTOSOIDES (CHLRO ROPHYTA),
Rhode Island Univ., Kingston. Dept. of Botany.
M. D. Nanisak, and M. M. Harlin.
Journal of Phycology, Vol 14, No 4, p 450-454, 1978. 1 Fig, 3 Tab, 21 Ref.

Descriptors: *Chlorophyta, *Nitrogen, *Kinetics, *Nutrients, *Northeast US, *Coasts, Algae, Light intensity, Temperature, Nitrates, Nitrites, Ammonium salts, Inorganic compounds, Nitrogen compounds, Ecological distribution, Cycling nutrients, Nutrient requirements, Plant physiology, Diets, Competition.

Codium fragile subsp. tomentosoides is a green coenocytic seaweed abundant in coastal areas along northeastern U.S.; its ecological success might be because it takes up several nitrogen (N) forms simultaneously, takes up N in darkness, and has relatively low K-s values for N uptake. Thalli were collected at Narragansett, Rhode Island, and laboratory tests on temperature and irradiance effects on nitrate nitrite, and ammonium uptake by Codium were examined. Under all temperature and irradiance combinations, ammonium uptake rates are greater than nitrate and nitrite. For all N forms, uptake is greater at 12-24C than at six and 30C. Maximum ammonium uptake rate (27.07 micro mol/g Dw/h) occurs at 84 micro Ein/sq m/s and 24C. Maximum nitrite uptake rate (3.3 micro mol/g Dw/h) occurs at 14 micro Ein/sq m/s and 24C. Maximum nitrate uptake rate (4.24 micro mol/g Dw/h) occurs at 140 micro Ein/sq m/s and 18C. Uptake rates, reduced in darkness, are 24%, 40%, and 51% the saturation rate for nitrate, nitrite, and ammonium, respectively. Michaelis-Menten constants vary with temperature. V-max for ammonium is 2.5-5 times greater than that for other N forms. V-max is greatest at 18 and 24C for nitrate and at 12-24C for nitrite and ammonium. K-s is much lower for ammonium than other N forms. Codium takes up different N forms simultaneously, giving it competitive advantage over other algae. (Danovich-Wisconsin)
W80-01462

PRODUCTION AND ENERGY FLOW IN THE MACROBENTHOS OF TWO SANDY BEACHES IN SOUTH WEST INDIA,
Dunstaffnage Marine Research Lab., Oban (Scotland).
A. D. Ansell, D. S. McLusky, A. Stirling, and A. Trevallion.
Proceedings of the Royal Society of Edinburgh, Vol 76, No 4, p 269-296, 1978. 4 Fig, 7 Tab, 69 Ref.

Descriptors: *Scotland, *India, *Energy budget, *Beaches, *Benthic fauna, *Secondary productivity, *Climatic zones, Population, Productivity, Production, Crustaceans, Bivalves, Regions, Tropic, Temperate, Rainfall, Water temperature, Respiration, Invertebrates, Mollusks.

Benthos production and energy flow along Shertallai and Cochin beaches, India, is compared with similar studies from Firemore Bay, Loch Ewe, Scotland; biomass turnover rates in tropical beaches are 10 times those of temperate beaches. Mean benthos biomass at Loch Ewe is 14.5 kcal/sq m compared with 2.82 kcal/sq m at Shertallai. Standing crop production of Loch Ewe benthos is estimated at 29 kcal/sq m/yr compared with 61.13 kcal/sq m/yr for Shertallai. Production:biomass ratios are two and 21.7 for Loch Ewe and Shertallai, respectively. Elimination to biomass ratios and mortality and longevity values are also used in the analysis. Indian benthos mortality values are most affected by salinity changes resulting from monsoon rainfall; seasonal temperature changes are small and food is constantly available. Polychaetes such as Glycera alba. Lumbriconeis latrelli, Onuphis eremita, and Scoloplos marsupialis decline in numbers during pre-monsoon and early monsoon periods followed by a post-monsoon increase. Benthos predation is affected by benthic invertebrate density and turnover. High tropical benthos species turnover rates reflect lack of physiological temperature compensation as compared with temperate species. Associated with higher metabolic rates at normal environmental temperatures, tropical species exhibit greater activity and mobility, faster growth rates, shorter life span, higher mortality rates, and greater production per unit biomass than temperate species. (Danovich-Wisconsin)
W80-01463

OXYGENATION OF A POLLUTED LAKE IN NORTHERN ITALY,
Milan Univ. (Italy). Inst. of Geology.
For primary bibliographic entry see Field 5G.
W80-01464

PROCEEDINGS OF THE 1979 U.S. FISH AND WILDLIFE SERVICE POLLUTION RESPONSE WORKSHOP, 8-10 MAY 1979, ST. PETERSBURG, FLORIDA.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, DC., 20402. U.S. Fish and Wildlife Service, Division of Ecological Services, Washington, D.C. September 1979. C. H. Brown, Editor, 218 p.

Descriptors: *Oil spill, *Hazardous substances, Chemical wastes, Detergents, *Fishkill, Fuels, Pollutants, *Water pollution effects, Water pollution sources, Animal populations, Aquatic environment, *Aquatic habitats, Aquatic life, Aquatic populations, Beaches, Coastal marshes, Estuarine fisheries, Fish populations, Fresh water marshes, Habitats, Lakes, Lake fisheries, Marine fisheries, Marshes, Shoreline cover, Spawning, Stream fisheries, Wildlife habitats, Endangered species.

The Proceedings are a compilation of papers presented at the Fish and Wildlife Service (FWS) 1979 Pollution Response Workshop, held 8-10 May 1979, in St. Petersburg, Florida. The primary purpose of the workshop was to provide FWS personnel with continuing training in responding to spills of oil and hazardous substances that may impact fish and wildlife resources and their habitats. Papers in the volume are divided into six subject areas: introductory material and a definition of the spill response problem; elements of Federal, State, local government and industry response to pollution discharges; biological and physical impacts of oil and hazardous substances; spill response techniques, including containment technology and wildlife rehabilitation; interfacing with the public, news media, and other agencies in crisis situations; and documentation of spills and environmental damage for purposes of litigation and the development of new prevention strategies.
W80-01540

ALGAL ASSAY AND CHEMICAL ANALYSIS: A COMPARATIVE STUDY OF WATER QUALITY ASSESSMENT TECHNIQUES IN A POLLUTED RIVER,
Illinois State Univ., Normal. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-01541

5D. Waste Treatment Processes

CONTROL OF FOAMING IN PULP AND PAPER MILL WHITE WATER,
Mississippi State Univ., Mississippi State. Dept. of Chemical Engineering.
G. R. Lightsey, and W. B. Hall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-112741, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Mississippi State University Report, October 1979. 27p, 8 Fig, 7 Tab, 23 Ref. OWRT A-125-MISS(1), 14-34-0001-9026.

Descriptors: *Water reuse, *Pulp and paper industry, *Foaming, *Recycling, *Foaming properties(Paper machine), Defoamers.

The purpose of this study was to determine the effect of water reuse on the paper machine white water properties in a pulp and paper mill with emphasis on foaming properties. Recycling of paper machine white water at recycle rates between 65% and 95% was simulated in the laboratory using both bleached and unbleached kraft pulp. The properties of the simulated white water was compared with actual paper machine white water at similar recycle rates. The data indicated that the laboratory simulation gave white water with properties reasonable close to actual paper machine white water. Both the white water's foaming tendency and its foam stability increases rapidly as the rate of white water recycle increases. Control of foaming in white water by the addition of defoamers was found to be less effective as the white water recycling rate increased. For example, to maintain the foam volume below 30 ml/1 of white water requires 20 ppm defoamer at 85% white water recycle and 50 ppm defoamer at 95% recycle. Increased white water reuse will result in greater foaming tendency and foam stability. However, this foaming can be controlled by increasing the concentration of defoamer in the white water.
W80-01261

ECONOMIES OF SCALE IN SEWAGE PURIFICATION AND DISPOSAL,
For primary bibliographic entry see Field 6C.
W80-01305

THE ECONOMIC IMPACT ANALYSIS OF EFFLUENT STANDARDS FOR TOTAL DISSOLVED SOLIDS,
Illinois Inst. of Natural Resources, Chicago.
For primary bibliographic entry see Field 6B.
W80-01310

WASTEWATER MANAGEMENT IN RURAL COMMUNITIES: A SOCIO-ECONOMIC PERSPECTIVE,
Pennsylvania State University, University Park, Institute for Research on Land and Water Resources, Information Report 103, May 1977. 154 p, 4 Fig, 15 Tab, 245 Ref. C. E. Young and D. J. Epp, editors.

Descriptors: *Wastewater, *Wastewater treatment, *Land application, *Sludge, *Legal aspects, *Rural areas, *Municipalities, *Political aspects, *Social aspects, *Planning, *Water quality control, Economics, Wastewater injection, Trickling filters, Activated sludge, Percolation, Spray irrigation, Infiltration, Land acquisition methods, Resource recovery, Wastewater reuse, Landfills, Dewatering, Federal Water Pollution Control Act, 208 Water quality planning.

This is a collection of seven papers which address planning, management and legal issues in wastewater use and application in rural communities. Activated sludge, trickling filters and lagoons are proposed as potential wastewater land application systems which can be installed at reasonable cost. Management considerations for choosing a treatment alternative include acquisition options (e.g., the fee simple option), and legal considerations (small communities stand to protect themselves legally by renting use of treatment facilities rather than building their own). Landspreading of sludge can provide small communities with a low cost, income producing means of waste treatment and disposal, but a strong educational program on

these advantages is seen as needed in rural areas. Rural areas have difficulty accepting as viable many land application methods due to their perceptions about possible health hazards and associated heavy metals disposal. A system of transferable discharge rights is proposed as an alternative charge system mechanism for communities, and can even provide optimum levels of environmental protection. Implementation of 208 Water Quality Planning could well change the distribution of rural land rights. General findings are that land application methods have feasibility for rural communities, but such communities will have to plan financing mechanisms carefully in order to afford land application in any form. (Arnold-NC)
W80-01383

ALTERNATIVES FOR SMALL WASTEWATER TREATMENT SYSTEMS: VOL. 1, ON-SITE DISPOSAL/SEPTAGE TREATMENT AND DISPOSAL.
Environmental Protection Agency, Cincinnati, OH. Office of Technology Transfer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 609, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA-625/4-77-011. October 1977. 91 p, 34 Fig, 30 Tab, 144 Ref.

Descriptors: *Waste water disposal, *Sewage disposal, *Septage disposal, *Waste water, *Waste treatment, *Waste disposal, *Septic tanks, *Operating costs, Water quality, Loading, Farm lagoons, Sewage effluents, Waste water irrigation, Aerobic treatment, Sludge, Ultimate disposal, Decomposition, Sewage lagoons, Solid wastes, Biological treatment, Chemical treatment.

This study proposes alternative wastewater collection systems, primarily for small, dispersed rural communities. Part I concludes that wastewater disposal in such areas can be a problem due to septic tank leakage and stream pollution from simple outfall dumping. Proposed for these areas are non-central wastewater facilities because they can adapt existing septic tank-soil absorption systems (ST-SAS), can avoid installation of costly sewer extensions, and allow more rational community growth planning. Design constraints in choosing an appropriate noncentralized community facility include water consumption, solids and pathogen reduction; ability to carry wastewater; holding tank storage; and nitrification potential. The Wisconsin Small Scale Waste Management Project (SSWMP) provided funds for specific research in this area. Part II examines septage treatment and disposal, used by over 25% of the population of 30 states. Natural digestion of septage wastes by aerobic organisms is fairly effective in most of the systems in these areas, yet occurrence of dangerous pathogens such as salmonella is still a serious problem. Various methods of septage-sewage disposal discussed included land disposal, subsurface application, spray irrigation, and aerated lagoons. Of these methods, land disposal was found to be least costly, although local constraints concerning land use, odors or poor soils, may preclude this option. (Arnold-NC)
W80-01384

ALTERNATIVES FOR SMALL WASTEWATER TREATMENT SYSTEMS: VOL. 2, PRESSURE SEWERS/VACUUM SEWERS.
Environmental Protection Agency, Cincinnati, OH. Office of Technology Transfer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 610, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-625/4-77-011b, October 1977. 99 p, 39 Fig, 14 Tab, 69 Ref, 2 Append.

Descriptors: *Waste water treatment, *Waste water disposal, *Waste disposal, *Solid wastes, *Sewage disposal, *Sewage systems, *Pressure sewers, *Vacuum sewers, Capital costs, Operating costs, Septic tanks.

This study discusses and analyzes the merits of pressure sewer and vacuum sewer systems as alternatives to septic tanks and simple outfalls in sparsely populated communities. Part I differentiates the two major types of pressure sewer systems: grinder pump (GP) and septic tank effluent pump (STEP) installations. Three model studies of uses of these systems in small communities indicated that costs of operation could be kept low. Design differences among GP and STEP systems are usually due to the type and materials of the effluent holding tank. Older tanks have been made of steel, but newer fiberglass tanks have been shown to operate efficiently and relatively inexpensively. Conclusions as to the usefulness and cost savings of pressure sewer systems indicate that they are a viable alternative to septic tanks where population density is low and rough terrain and soil conditions exist, and that they require lower capital costs and shorter construction times than conventional sewer systems. Part II deals with sewer systems relying on the vacuum method for waste collection, primarily for toilet systems. The various types of vacuum systems differ in their piping configurations, with the AIRVAC system using a large valve to regulate vacuum pressure. Although vacuum systems are relatively new to the United States, their installation results in reduced costs and water consumption of toilet systems. (Arnold-NC)
W80-01385

ALTERNATIVES FOR SMALL WASTEWATER TREATMENT SYSTEMS: VOL. 3, COST/EFFECTIVENESS ANALYSIS.
Environmental Protection Agency, Cincinnati, OH.
For primary bibliographic entry see Field 5G.
W80-01386

WATER QUALITY MANAGEMENT PLAN: EXECUTIVE SUMMARY.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div of Environmental Management.
July 1979, 27 p, 6 Fig.

Descriptors: *Water quality, *North Carolina, *Management, *Wastewater discharge, *Urban stormwater, *Agriculture, *Construction, *Mining, *On-site wastewater disposal, *Solid waste disposal, *Forestry, *Water pollution, Water quality control, Biodegration, Toxic substances, Sediment, Nutrients, Organic wastes, Bacteria.

This document is a summary of the principal information contained in the several separate volumes that compose North Carolina's Water Quality Management Plan. Of the 40,000 miles of streams in N.C. 2,762 miles (7 percent) are degraded, and of the over 2 million acres of estuarine water 446,909 acres (22 percent) are closed to shellfishing. Water pollutants are grouped into the following categories: organic wastes (or oxygen demanding substances), bacteria, sediment, nutrients, and toxic substances. The severity of biological degradation varies in the three major areas of the state--mountains, Piedmont, and coastal plain. The recommendations of the Plan range from educational efforts and voluntary compliance to more effective use or strengthening of existing regulatory programs. The Plan concentrates on actions state agencies can and should take. The recommendations are directed at protecting water from future activities, therefore, there are several situatons in which water quality degradation is not expected to improve as a result of the Plan. Two situations where this is true are some areas of shellfishing waters destroyed from septic tank leachate and the localized degradation of groundwater from poorly located landfills. The elements of the Water Quality Management Plan include the following (listed in decreasing order of overall contribution to N.C. water quality problems): (1) point source, (2) urban stormwater runoff, (3)agriculture, (4) construction, (5) mining, (6) on-site wastewater disposal, (7) solid waste disposal, and (8) forestry. (Iervolino-NC)
W80-01391

WATER QUALITY MANAGEMENT PLAN: IMPLEMENTATION SUMMARY,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div of Environmental Management.
July 1979. 94 p. EPA P004198010.

Descriptors: *Water quality control, *Water quality, *Waste water dicharges, *Urban stormwater, *Agriculture, *Construction, *Mining, *On-site wastewater disposal, *Solid waste disposal, *Forestry, *North Carolina, *Management, *Implementation, National Pollutant Discharge Elimination System(NPDES).

This report, an Implementation Summary of the North Carolina Water Quality Management Plan, presents water quality issues and recommendations for each of the eight topical plans which, taken together, comprise North Crolin's Water Quality Mangement Plan: Wastewater Discharges, Urban Storwater, Agriculture, Construction, Mining, ON-site Wastewater Disposal, Solid Waste Disposal and Forestry. There are a total of 68 recommendations. The report also includes the status of wastewater discharges in the state. All of the recommendations included are for state rather than local action and are to be implemented by state agencies. The responsibility of the Federal government, particularly the Environmental Protection Agency (EPA), is to provide to the state the financial support necessary to carry out effectiely the environmental mandates imposed by Federal legislation. The discharge inventory itemizes all facilities having an NPDES (National Pollutant Discharge Elimination System) permit to discharge wastewater to N.C. streams and rivers. There are more than 2300 discharges identified in the inventory. For each discharger the following information is collected and identified: receiving stream, community, ownership category, facility type, facility name, county, NPDES number, sub-basin, discharge rating, discharge category, design flow, discharge description (major/minor), compliance information, compliance schedule and expiration data. (Iervolino-NC)
W80-01392

WATER QUALITY AND WASTEWATER DISCHARGES: A MANAGEMENT PLAN.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div of Environmental Management.
July 1979. 98 p, 23 Ref, 8 Fig, 12 Tab, 1 Map. EPA P00498010.

Descriptors: *Waste water, *Water quality,*Waste water discharges, *North Carolina, *Management, *Water polluton, *Sewage effluents, *Water management(Applied), *Toxic wastes, *Waste treatment, *Sewage disposal, *Water pollution control, Federal Water Pollution Control Act, Waste water treatment, Waste water disposal, Effluents, Sewage, Sewage treatment, Water pollution sources.

One of a series of eight water quality management plan document which comprises the N.C. Water Quality Management Plan, this document is an assessment of wastewater disposal practices and programs in the state and their effect on water quality. The major pollutants discharged to streams include those wastes that deplete the dissolved oxygen in the water as they decompose, stimulate undesirable growth of plants or algae in the water, are toxic to fish, wildlife or humans, and cause disease in man. The planning and construction of publicly-owned wastewater treatment facilities is partially funded by both the Federal and State governments. The current program for control of wastewater discharges to streams in N.C. is based primarily on the Federal Water Pollution Control Act of 1972. Allowable discharges must meet certain requirements which are enforced through a permit program, the National Pollutant Discharge Elimination System (NPDES) managed by the U.S. Environmental Protection Agency (EPA). The NPDES permits are based principally on effluent guidelines which, prior to 1976, for the most part did not contain limits on any toxic or potentially toxic substances. Since 1976 EPA has agreed to establish effluent limitations and guidelines for certain agreed-upon toxic pollutant categories. The state has also adopted various approaches to advanced wastewater treatment in order to achieve the quality standards in special situations. Approximately half of the discharges in

N.C. need to treat their water using these advanced wastewater treatments, which are more stringent than normal treatments. North Carolina has adopted anti-degradation provisions which require that high quality waters be protected. (Iervolino-NC)
W80-01394

WATER QUALITY AND ON-SITE WASTEWATER DISPOSAL: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
July 1979, 56 p, 23 Ref, 5 Fig, 2 Tab. EPA P004198010.

Descriptors: *Wastewater disposal, *Water quality, *Septic tanks, *Sewage treatment, *Waste disposal, *North Carolina, *Managment, *On-site disposal, Wastewater treatment, Waste treatment, Water quality control, Treatment, Impacts.

This report, part of North Carolina's Water Quality Management Plan, evaluates the statewide significance of on-site waste disposal practices and problems with regard to their impact on water quality in North Carolina. Research was done on the extent of septic tank use in the state, impacts of septic tank systems on water quality practices which can prevent adverse impacts, and programs which affect on-site disposal methods. In 1970 42% of all housing units in the state were on septic tank soil absorption systems. Successful operations of a septic system depends upon: suitability of the soil to accept wastewater, level drainfield, eatablishment of a proper interface between the absorption trench and surrounding soils, timely pumping of septic tank solids and scum, minimal hydraulic and solids loading, and proper surface and subsurface drainage. Localize problems from septic tank systems can be traced to insufficient depth to water table, hydraulic overloading, malfunctions in small discharging systems, straight piping, infrequent septic tank pumping, improper septage disposal and high density housing development. Four North Carolina statutes govern the installation of on-site wastewater disposal systems in the state. The State's Coastal Area Management (GS 113A-100 to 113A-128) and shellfish sanitation (GS 130-169) regulations indirectly affect the siting and operation of on-site disposal systems in the coastal areas. Management practices and aternative actions are set forth for onsite waste disposal. The plan recommends a number of actions in the areas of education, research and administrative changes in order to reverse the trends of poor on-site wastewater disposal practices. (Iervolino-NC)
W80-01395

PACKAGE PLANTS: ONE SOLUTION TO SMALL COMMUNITY WATER SUPPLY NEEDS,
Culp/Wesner/Culp, El Dorado Hills, CA.
S. P. Hansen.
Journal of the American Water Works Association, Vol 71, No 6, p 315-323, June 1979. 12 Fig, 3 Tab, 11 Ref.

Descriptors: *Water treatment, *Waste water treatment, *Water quality, *Alternative costs, *Cost comparisons, *Package plants, *Plant design, Water supply, Water demand, Custom plants, Filtration, Water quality standards, Costs.

Package water treatment plants (compact, factory built units which incorporate coagulation flocculation, sedimentation, and filtration) offer an economical means for small communities to treat water supplies to conform to upgraded (Federal/state) water quality standards. Normally such a package plant with a 1.5 million gallons/day (mgd) could serve a community of 10,000 persons. A model package plant which could meet these needs is presented; it employs a combination of tube settlers and mixed media filters to encompass a small enough unit that is factory assembled, yet meets small city flow requirements. Criteria for choosing a particular type of package plant for a given location include its ability to meet the area's water quality standards and required water quantity flow rate, meeting certain treatment conditions such as low raw water temperature or flashy turbidity, and as complete knowledge of the treatment characteristics of the raw water as possible. 'Operator-proof' design to avoid human-caused damage must be considered in package plant selection, and package plants will probably be less costly than custom built plants primarily for flow capacity rates below 2 mgd/day. Each individual community situation should be analyzed, to determine if in fact a package plant will answer its needs. (Arnold-NC)
W80-01404

WASTEWATER ENERGY RECYCLING METHOD,
L. G. Erickson, and H. E. Worne.
U.S. Patent No 4,159,944, 7 p, 3 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 984, No 1, p 138, July 3, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water reuse, *Irrigation water, Microbial degradation, Fertilizers, Disinfection, Separation techniques, Product recovery.

An auxiliary process and method for use in wastewater treatment plants modifies conventional primary and secondary treatment to condition the effluent for use as agricultural irrigation water containing liquified fertilizer and soil amendment materials. Primary sludge and skimmed materials are comminuted and added to the volume of organic materials available for secondary treatment. A bacterial inoculum is added to accelerate the microbial reduction of biodegradable materials into a biomass of cells. The seperated predominately cellular secondary sludge is processed to rupture the cellular structure thus releasing the protoplasm to colloidal suspension. Combined with the mainflow of secondary clarified effluent, the resultant micro-particulate effluent is thereby conditioned for effective chelation treatment to remove heavy metal ions and for effective disinfection with reduced requirements for toxic reactants. The product is discharged as agricultural irrigation water containing, in solution, agricultural fertilizers as nitrogen, minerals, carbonaceous compounds and oxygen, plus ligno-cellulose soilbuilding materials. The heavy metals may be separated and recycled as a by-product. (Sinha-OEIS)
W80-01475

METHOD FOR DENITRIFICATION OF TREATED SEWAGE,
Dravco Corp., Pittsburgh, PA. (Assignee).
E. S. Savage.
U.S. Patent No 4,159,945, 5 p, 1 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 984, No 1, p 138, July 3, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Denitrification, *Filtration, Nitrogen compounds, Microbial degradation, Activated sludge, Separation techniques, Water purification, Backwashing.

A method for denitrification of aqueous nitrate-containing solutions provides for denitrification of the effluent from an activated sludge sewage treatment process. Effluent from the settling zone of an activated sludge sewage treatment process containing nitrogen compounds such as nitrates and nitrites, is passed through a deep bed filter, the filter media of which has been innoculated with bacteria that converts the nitrogen compounds to nitrogen gas. The filter, in addition to removing the nitrogen compounds, also removes suspended solids from the settling zone effluent, so that the final effluent from the filter is concurrently clarified and denitrified. By controlling the backwash of the filter, bacteria is retained thereon so as to enable continuous use of the filter. (Sinha-OEIS)
W80-01476

DEWATERING SYSTEM,
L. L. Brooks, and D. A. McMillon.
U.S. Patent No 4,159,947, 9 p, 3 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 984, No 1, p 138-139, July 3, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Sludge treatment, Separation techniques, Dewatering, Filtration, Slurries, Flocculation, Equipment, Endless belts.

The invention comprises a dewatering system for removing water from flowable aqueous material, such as a slurry or sludge wherein a flocculation agent is added to the slurry if necessary. The mixture is deposited as a slurry on an endless porous filter belt movable along its length through an upper run over vacuum chambers and then into sandwiched relationship with respect to a second endless porous filter belt. The belts and their intermediate layer of the slurry are passed about an arc of a dewatering drum, and then in a sinuous path about rollers in a return run. Tension is applied to high tension belts so that additional squeezing forces are applied to the layer of the slurry. (Sinha-OEIS)
W80-01478

METHOD AND APPARATUS FOR REMOVAL OF POLLUTANTS FROM WASTE WATER,
A. J. Kovacs.
U.S. Patent No 4,160,723, 8 p, 6 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 413, July 10, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Sewage treatment, Separation techniques, Activated sludge, Aeration, Equipment.

An apparatus is provided for removing pollutants from waste water. An activated sludge system is disclosed comprising generally a two tank system in which uniquely designed and positioned air diffusion and liquor transfer systems are utilized in combination with improved tank designs to effectively carry waste water through aeration and clarification stages to provide a fluid of a purification level not heretofore attainable from small activated sludge systems. (Sinha-OEIS)
W80-01480

WASTE WATER TREATMENT,
Ontario Research Foundation, Sheridan Park. (Assignee).
R. V. Laughton.
U.S. Patent No 4,160,724, 13 p, 3 Fig, 10 Tab, 9 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 413-414, July 10, 1979.

Descriptors: *Patents, *Waste water treatment, *Biological treatment, Industrial wastes, Domestic wastes, Denitrification, Microbial degradation, Separation techniques, Equipment.

Removal of nitrogeneous and carbonaceous contaminants from waste water is carried out in a single sludge two-tank system by a symbiotic two-step process whereby the second tank mainly oxidizes ammonia to nitrate and the first tank mainly reduces nitrate to nitrogen gas. The biological sludge is the same in both tanks but different reactions occur as the mixed microbial population moves through various environmental conditions in the tanks. Most of the carbonaceous material is removed in the first tank by a combination of biological uptake with cell growth and use of the carbon as a final electron acceptor in respiratory denitrification. (Sinha-OEIS)
W80-01481

WASTE WATER PURIFICATION PROCESSES,
Centre de Recherches Metallurgiques, Brussels (Belgium). (Assignee); and Siderurgiemaritime Maritime Staalnijverheid, Ghent (Belgium). (Assignee).
C. Josis, and A. Hans.
U.S. Patent No 4,160,725, 6 p, 2 Fig, 6 Ref; Official Gasette of the United States Patent Office, Vol 984, No 2, p 414-415, July 10, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water purification, Separation techniques, Ammonia, Phenols, Flow, Chemical reactions, Coke oven wastes, Stripping columns.

Waste water from coke ovens is purified by passing the waste water and a stripping fluid through a stripping column in counterflow. Non-volatile ammonium compounds are removed in one region of the column, phenolic compounds are removed in another region, and volatile ammonium compounds are removed in yet another region. The region in which phenolic compounds are removed is disposed at such a location that no ammoniacal vapor can traverse it. An acid and a strong base are fed laterally into the column at two different levels. (Sinha-OEIS)
W80-01482

METHOD FOR SEPARATING OILS FROM WATER,
Chevron Research Co., San Francisco, CA. (Assignee).
R. S. Wilcox.
U.S. Patent No 4,160,729, 3 p, 8 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 416, July 10, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Oily water, Oil pollution, Separation techniques, Adsorption, Deoiled petroleum asphalt bottoms.

The invention concerns a method for improving oil-contaminated water which comprises: contacting the water with a porous asphalt; and separating the resulting oil-containing bottoms from the water. The term 'asphaltic bottoms' is meant the pitch-like residue normally obtained in the processing of heavy petroleum crude oils. These materials in their deoiled form are porous and capable of acting as a sponge for oleaginous materials. The contacting of the oil-polluted water may be by any suitable means, including passing the water through a bed of particulate (pulverized, shaped, prilled, comminuted, spherized, and the like) deoiled asphaltic bottoms. The absorbed oil may be separated and recovered from the resulting oil-impregnated asphaltic bottoms by any suitable means, including solvent extraction, heating and vaporization, and the like ordinary hydrocarbon separation methods. (Sinha-OEIS)
W80-01484

PROCESS FOR MERCURY REMOVAL,
Domtar Inc., Montreal (Quebec). (Assignee).
X. T. Nguyen.
U.S. Patent No 4,160,730, 6 p, 1 Fig, 3 Tab, 5 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 416, July 10, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water pollution treatment, *Mercury, *Separation techniques, Chemical reactions, Entrainment, Product recovery, Hypochlorite.

A process for the removal of mercury from aqueous media containing mercury and undissolved solids comprises, adding hypochlorite to the aqueous medium, reducing the ionic mercury to elemental mercury, aerating the aqueous medium with a gas to entrain the mercury and separating the mercury from the entraining gas. (Sinha-OEIS)
W80-01485

CATCH BASIN PROCESSING APPARATUS,
LRS Research Ltd., Broomall, PA. (Assignee).
L. P. Taylor, and A. Petroski.
U.S. Patent No 4,160,734, 12 p, 2 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 417, July 10, 1979.

Descriptors: *Patents, *Waste treatment, *Sludge treatment, *Lagoons, Sewage lagoons, Cleaning, Equipment, Waste dilution, Catch basins.

A mobile system for cleaning and processing catch bains and/or lagoon waste products is described wherein the degree of waste product dilution is carefully controlled prior to transmission to the mobile dewatering truck. The system is capable of producing a substantially dry land fill end product and water suitable for recirculation or environmentally acceptable discharge to a process head or sanitary sewer. (Sinha-OEIS)
W80-01486

ROTATING TRICKLING FILTER,
Autotrol Corp., Milwaukee, WI. (Assignee).
D. G. Prosser.
U.S. Patent No 4,160,736, 10 p, 7 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 418, July 10, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Biological treatment, Filtration, Trickling filters, Equipment, Oxygen.

A rotating trickling filter is formed from an elongated, hollow, circular cylindrical shell in which fixed film contractor media is mounted. Wastewater is introduced through an inlet at one end of the shell and exits through an outlet at the opposite end. The volume of wastewater within the shell is maintained as a small fraction of the total volume within the shell and collects as a shallow pool of wastewater at the bottom of the shell. Longitudinal channels sweep through the pool of wastewater as the shell is rotated to raise wastewater and discharge it over the media, which also rotates with the shell. In another embodiment, the shell is mounted within a holding tank of wastewater and is driven by the release of gas under pressure from a conduit beneath the shell, with the gas being trapped in cups arranged about the perimeter of the shell. (Sinha-OEIS)
W80-01487

PROCESS FOR TREATING WASTE WATER CONTAINING RADIOACTIVE SUBSTANCES,
Caicel Lts., Osaka. (Assignee); and Mitsui Shipbuilding and Engineering Co., Ltd., Tokyo (Japan). (Assignee).
K. Kokima.
U.S. Patent No 4,161,447, 6 p, 3 Fig, 2 Tab, 9 Ref; Official Gazette of the United States Patent Office, Vol 984, No 3, p 666, July 17, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, *Radioactive wastes, Reverse osmosis, Surfactants, Separation techniques, Membranes.

The invention provides a process for treating waste waters containing one or more radioactive substances with a reverse osmotic membrane device in the presence of at least one organic surfactant selected from the group consisting of anionic surfactants, cationic surfactants and non-ionic surfactants, in an amount in the range of from 0.1 to 1.0 weight percent effective to remove more than 99 weight percent of the radioactive substances. (Sinha-OEIS)
W80-01497

CLEAN WATER ACT, RSOURCE CONSERVATION AND RECOVERY ACT AND CONTROLS ON WETLANDS AND THE COASTAL ZONE,
For primary bibliographic entry see Field 6E.
W80-01557

ELECTRICAL POWER COMMITTEE (ANNUAL REPORT): PART II B. CLEAN WATER ACT (CWA) DEVELOPMENTS,
American Bar Association, Washington, DC. Natural Resources Law Section.
For primary bibliographic entry see Field 6E.
W80-01558

5E. Ultimate Disposal Of Wastes

WASTEWATER MANAGEMENT IN RURAL COMMUNITIES: A SOCIO-ECONOMIC PERSPECTIVE,
For primary bibliographic entry see Field 5D.
W80-01383

ALTERNATIVES FOR SMALL WASTEWATER TREATMENT SYSTEMS: VOL. 1, ON-SITE DISPOSAL/SEPTAGE TREATMENT AND DISPOSAL.
Environmental Protection Agency, Cincinnati, OH. Office of Technology Transfer.
For primary bibliographic entry see Field 5D.
W80-01384

OCEAN OUTFALL WASTEWATER DISPOSAL FEASIBILITY AND PLANNING.
North Carolina State Univ. at Raleigh, NC; and East Carolina Univ., Greenville, NC.; and North Carolina at Chapel Hill.
Final Report prepared for Coastal Plains Regional Commission and North Carolina Department of Administration, April 30, 1979. 430 p, 72 Fig, 46 Tab, 971 Ref, 12 Append.

Descriptors: *Waste water disposal, *Waste disposal, *Effluents, *Oceans, *Estuaries, *Feasibility studies, *Sewage treatment, *Sewage facilities, *Outfalls, *Planning, North Carolina, Water pollution control, Conduits, Benthic organisms, Water quality, Marine organisms, Sewage dispersion, Multiport line diffuser system, Social aspects, Health aspects, Economic aspects, Water pollution sources.

The main objectives were (1) to develop models to predict nearshore mixing and dispersion of outfall deposits; (2) to provide a general assessment of the biological, public health, economic and social impacts of coastal waste treatment plants with offshore outfalls; and (3) to develop computational tools and assessment methodologies that could be employed in site-specific evaluations for treatment plant location. Methodologies and research activities used are described in detail. Population data for North Carolina coastal counties were reviewed in order to identify possible ocean outfall locations. Effluent volume for these areas is expected to vary from about 1 to 14 million gallons per day (mgd) by the year 2000. The current practice for effluent discharge, mixing and dispersion would require the use of a multiport line diffuser outfall system for ocean outfall. Benthic communities beyond the immediate vicinity of the outfall pipe and diffuser would not be measurably altered, but heavy metals and other toxic substances may accumulate in the sediments in the immediate vicinity of the diffuser. There would be no adverse public health or socio-economic effects. Major findings indicate that construction and operation of a well-designed and operated sewage treatment plant utilizing ocean outfall and secondary treatment should not adversely affect the water column on fishery resources; effluent discharge should have no adverse affect on recreational swimming and areas now closed to shell fishing could be reopened as a result of reduced pathogen loadings; and that centralized sewer systems will increase land values and stimulate growth. (Arnold-NC)
W80-01402

5F. Water Treatment and Quality Alteration

REMOVAL OF NATURALLY OCCURRING MANGANESE FROM ALABAMA WATERS BY RAPID SAND FILTRATION USING CALCIUM AS AFILTER AID,
Auburn Univ., Al. Dept. of Civil Engineering.
S. R. Jenkins.
271ilable from the National Technical Information Service, Springfield, VA 22161 as PB80-111909, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute Auburn University, Bulletin 40, October 1979, 48 p, 14 Fig, 2 Tab. OWRT A-064-ALA (3), 14-34-0001-9001.

Descriptors: *Water treatment, *Manganese, *Filtration, *Calcium, *Rapid sand filters, Lime, Alabama;.

Natural waters that have high concentrations of manganese and low concentrations of calcium are found throughout Alabama. Impounded lakes that are used as sources of public water supply are generally in the east central or northeast section of Alabama. This region includes the Limestone Valleys and Uplands, the Appalachian Plateau, and the Piedmont Plateau. Supplemental doses of calcium were shown to enhance the removal of oxi-

dized manganese by rapid sand filters. The effectiveness of 2.54 cm ID 10.2 cm deep model filters to remove the MnO2 using Ca2+ as a filter aid was shown to increase as the pH was raised. Lime was shown to act as a single chemical to both raise the pH and enhance removal by interacting with the oxide surfaces. While addition of alum to a solution of oxidized manganese improves removal by the model filters, small doses of calcium can substantially reduce the alum dosage required for maximum removal. The chemical costs can be significantly reduced by conscientious treatment of manganese-bearing water with lime.
W80-01205

TREATMENT OF AQUEOUS SYSTEMS,
CIBA GEIGY Ltd., London (England). (Assignee).
M. J. Smith, P. Miles, N. Richardson, and M. A. Finan.
U.S. Patent No 4,159,946, 8 p, 4 Tab, 4 Ref; Official Gazette of the United States Patent Office, Vol 984, No 1, p 138, July 3, 1979.

Descriptors: *Patents, *Water treatment, *Water quality control, *Industrial water, *Scaling, Corrosion, Desalination apparatus, Heat exchangers.

A method is provided for inhibiting the precipitation of the scale forming salts of calcium, magnesium, barium and strontium from aqueous systems over a wide temperature range. It comprises adding to the aqueous system a minor proportion of a product comprising a telomeric compound. Salts of the telomeric compounds of the formula are compounds in which some or all of the acidic hydrogens have been replaced by alkali metal ions, ammonium ions or quaternised amine radicals. These salts also have good activity in inhibiting the precipitation of insoluble salts from aqueous solution. (Sinha-OEIS)
W80-01477

METHOD AND APPARATUS UTILIZING STAGED REVERSE OSMOSIS UNITS FOR PURIFYING AND DISPENSING WATER,
Foremost-McKesson, Inc., San Francisco, CA. (Assignee).
R. M. Harris, Jr.
U.S. Patent No 4,160,727, 10 p, 5 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 415, July 10, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, *Reverse osmosis, Flow rate, Membrane processes, Equipment, Water softening, Coin-operated dispenser.

The invention utilizes successive reverse osmosis stages to produce highly purified water from potable water in a manner particularly suitable for use in a coin operated vending machine. The flow rates in the reverse osmosis stages are matched so that no storage tank is required between them. Operation of the purification stages is controlled by the level of purified water in a reservoir from which it is dispensed, and the level is automatically maintained within a predetermined range. A sump pan is mounted under the remainder of the machine to catch spillage, waste, and reject (brine), a sump pump is automatically actuated when the water reaches a predetermined level in the sump pan, and a valve at the feed water inlet is closed automatically in the event that the water level gets too high in either the sump pan or the reservoir. The machine will not accept coins in the event that the water in the reservoir drops to the predetermined level or fails to meet a desired standard of purity. (Sinha-OEIS)
W80-01483

WATER PURIFICATION DEVICE AND SYSTEM,
G. A. Guter.
U.S. Patent No 4,160,738, 9 p, 6 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 984, No 2, p 419, July 10, 1979.

Descriptors: *Patents, *Water purification, *Water treatment, *Water quality control, Filtration, Reversis osmosis, Equipment, Domestic water.

A water purification unit particularly adapted for household use and for operation at high pressures, includes two main co-operating parts forming a chamber, with a seal positioned between the parts, and a cap compressing the seal and holding the two parts together. The interior of the chamber can contain one or more filtering elements such as a particulate matter filter, a carbon filter or a reverse osmosis filter. To withstand high internal pressure without leakage or damage, mechanical connections are provided within the chamber to form a further positive connection between the two main parts. Tap water is fed to the unit and purified outlet product water is discharged and introduced drop by drop into an open container, affording an aerated storage reservoir or purified water ready for use. The container includes a water overflow means from the container to an outlet drain and in addition waste water from the water purification units is also discharged to the drain. (Sinha-OEIS)
W80-01488

PROCESS FOR THE DESALINATION OF SALT CONTAINING WATER,
For primary bibliographic entry see Field 3A.
W80-01495

PROCESS FOR THE TREATMENT OF GROUND WATER,
For primary bibliographic entry see Field 3A.
W80-01496

5G. Water Quality Control

EFFECT OF QUARRY BLASTING ON GROUND-WATER QUALITY IN A LIMESTONE TERRANE IN CALHOUN COUNTY, ALABAMA,
Geological Survey of Alabama, University.
J. D. Moore, and T. H. Hughes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-111735, Price Codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute, Auburn University, Bulletin 38, August 1979, 72 p, 12 Fig, 5 Tab. OWRT A-063-ALA (1), 14-34-0001-8001.

Descriptors: *Turbidity, *Water quality, *Water wells, Rock excavation, Quarrels, *Oxford(AL), Blasting.

A number of rural residents near Oxford, Alabama, reported recurring problems in turbidity of water from their individual water-supply wells and, occasionally, decreases in yield. Many residents associated the problems with blasting operations in a local rock quarry. Quarry operators were concerned about claims for damage that may relate to their activities. This research assessed parameters which could possibly be used to determine if a relationship does exist between quarry blasting and deterioration of well performance and groundwater quality. No relationship was established between blasting events and the quality of water of water in wells. Most turbidity problems occured during the dry period of the year (October-December) when water levels in some wells are as much as 40 feet lower than during summer months. Turbid or muddy water in some wells results from heavy rainfall. Heavy use of ground water, particularly during extended dry periodiods, contributes significantly to the problem. Chemical analyses provided no evidence to indicate that either the degree of attainment of chemical equilibrium or the concentrations of either major constituents or trace elements in the water has been affected by blasting. (Warman-Ala)
W80-01207

ENERGY REQUIREMENTS OF PRESENT POLLUTION CONTROL TECHNOLOGY,
Monsanto Research Corp., Dayton, OH.
For primary bibliographic entry see Field 6C.
W80-01311

ASSESSMENT OF THE ECONOMIC AND SOCIAL IMPLICATION OF WATER QUALITY IMPROVEMENTS ON PUBLIC SWIMMING,
Battelle Columbus Labs., OH.
For primary bibliographic entry see Field 6B.
W80-01314

MOBILIZATION AND ACCUMULATION OF HEAVY METALS IN FRESHWATER WETLANDS,
Connecticut Univ., Storrs. Inst. of Water Resources.
W. H. Damman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116296, Price codes: A02 in paper copy, A01 in microfiche. Research Project Technical Report, 1979. 14 p, 6 Fig, 1 Tab, 4 Ref. OWRT A-073-CONN (1), 14-31-0001-6007.

Descriptors: *Heavy metals, Nutrients, *Water levels, Hydrogen sulfide, *Connecticut, *Wetlands, Peat, Sampling, Corls, Soil water movement, Red maple swamp, Spagnum bog.

The vertical distribution of Zn, Pb, Mn, Cu, Ni, K, Na, N, Fe and Al, was studied in a series of cores taken from two Connecticut wetland types: a mesotrophic red maple swamp and an oligotrophic Sphagnum bog. Parts of the red maple swamp affected by spring and seepage water contain much higher concentrations of Cu, Ni, Mn, Fe, Na and K than the rest of the swamp or the bog. Lead, Mn and Fe concentrations are highest above the anaerobic level. Of the heavy metals, only Mn and Zn are enriched by nutrient cycling in the surface horizons of the swamp. This is best expressed in the higher parts of the swamp. The annual growth of a low Sphagnum flavicomans hummock contains amounts of Zn and Cu roughly equal to the annual atmospheric input, but only 1/2 of the Pb and 1/3 of the Ni. Apparently, Ni, Cu, and Mn are leached from the surrounding uplands into the swamp but this affects only the border areas. The red maple swamp does not act as a sink for Pb and Zn. Atmospheric input appears to be the only source of heavy metals in the surface of the bog.
W80-01379

ALTERNATIVES FOR SMALL WASTEWATER TREATMENT SYSTEMS: VOL. 2, PRESSURE SEWERS/VACUUM SEWERS.
Environmental Protection Agency, Cincinnati, OH. Office of Technology Transfer.
For primary bibliographic entry see Field 5D.
W80-01385

ALTERNATIVES FOR SMALL WASTEWATER TREATMENT SYSTEMS: VOL. 3, COST/EFFECTIVENESS ANALYSIS.
Environmental Protection Agency, Cincinnati, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 611, Price codes: A03 in paper copy, A01 in microfiche. Report No EPA-625/4-77-011c, October 1977. 1 Fig, 15 Tab, 12 Ref.

Descriptors: *Waste water treatment, *Waste water disposal, *Sewage systems, *Operating costs, *Sewage disposal, *Sewage treatment, *Cost/effectiveness analysis, *Community collection systems, Soil permeability, Septic tanks, Sewers, Waste treatment, Septic tank-soil absorption system, Groundwater, Alternative systems, Pressure sewers, Vacuum sewers, Soil conditions.

The objective of this study is to present specific information on cost/effectiveness analysis of sewerage systems for small communities and residential areas. Procedures for use in determining the feasibility and desirability of four on-site systems and four types of community collection systems are presented. The septic tank-soil absorption system (ST-SAS) was found to be the best and least costly of all four on-site systems under good (permeable) soil conditions. Generally, the four on-site systems were more effective and less costly for small community use than were the collection systems. Some limitations to on-site systems included

loss of efficiency in cold climates, restrictive use in certain soils, and the need for at least 4 feet of groundwater depth. Community collection systems excelled in providing operation in a wide range of climates and centralized control, but were costly to construct and required extensive maintenance. National Pollution Discharge Elimination System (NPDES) requirements restrict use of some on-site systems, as these systems lack efficient effluent screening. If costs allow, the conventional gravity sewage collection system is the best type of community system, but it is frequently not feasible for many sparsely developed communities. Case histories for five communities are presented to show how and why relatively innovative and nonconventional wastewater collection systems have been developed and in some cases selected as the most cost-effective solution to sewerage problems in small communities. The communities presented are: Glide-Idleyld Park (OR), Bellevue (ID), Westboro (WI), Fountain Run (KY), and East Ryegate (VT). (Arnold-NC)
W80-01386

SUBMARINE WASTERWATER OUTFALL - NEAR FIELD FLOW DYNAMICS AND MIXING,
North Carolina State Univ. at Raleigh. Dept. of Mechanical and Aerospace Engineering.
For primary bibliographic entry see Field 6A.
W80-01387

WATER QUALITY AND AGRICULTURE: A MANAGEMENT PLAN,
North Carolina Soil and Water Conservation Commission, Raleigh. Div. of Land Resources.
1979. 106 p, 27 Ref, 12 Tab, 25 Fig.

Descriptors: *Water quality, *Agriculture, *North Carolina, *Sediments, *Management, *Water quality control, *Water pollution sources, *Water pollution control, *Nonpoint source pollution, Sediment control, Erosion, Erosion control, Nutrients, Pesticides, Agricultural runoff, Agricultural chemicals, Water pollution, Sedimentation, Farm mangement.

This report describes the 208 Agricultural Nonpoint Source (ANPS) Pollution study conducted in North Carolina and the selected implementation approach. Agriculture is the largest industry in North Carolina. In 1978 the state ranked first in the south and tenth in the nation with farm production valued at over $3.2 billion; over $1 billion is from tobacco alone. Farms cover 42% of the state's land area; therefore, the impact of these activities on water quality is potentially high. Impacts on water quality result from rainfall runoff carrying nutrients, sediment and pesticides off the fields and into nearby streams. Certain nutrients and pesticides, if found in a high enough concentration, can cause potential health or water quality problems; however, sediment is considered to be North Carolina's greatest water pollutant, especially in the Piedmont region. Programs which assist farmers in developing and applying sound farm management systems are Agricultural Research Service, Cooperative Extension Serice, N.C. Dept. of Agriculture, the Soil and Water Conservation Commission, USDA-Soil Conservation Service (SCS), USDA-Farmers Home Administration and USDA-Agricultural Stabilization and Conservation Service. Three possible implementation approaches for pollution control efforts were evaluated: (1) no change, 2(2) regulatory controls, and (3) voluntary approach. Conclusions indicated that a voluntary approach toward pollution control involving education, technical assistance and cost-sharing appears to be workable and immediately implementable. This approach would be most acceptable to the agricultural community. This voluntary program would seek to reduce ANPS inputs to acceptable levels. (Iervolino-NC)
W80-01393

WATER QUALITY AND ON-SITE WASTEWATER DISPOSAL: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5D.
W80-01395

WATER QUALITY AND FORESTRY: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
July 1979, 52 p, 32 Ref, 5 Tab, 5 Fig. EPA P004198010.

Descriptors: *Water quality, *North Carolina, *Forest management, *Management, *Silviculture, *Planning, *Water pollution control, Erosion control, Forestry, Sediment control, Lumbering, Erosion, Timber, Water quality control.

Part of North Carolina's Water Quality Management Plan, this document is an assessment of forestry in the state and its impact on water quality. Forests cover about 64% of North Carolina's land and are relied upon to meet a variety of needs. Commercial forests occupy 19.5 million acres and provide the resource base for the timber industry which ranks second only to textiles in the value of manufactured output in N.C. The principal potential water pollutants that may be generated by silvicultural activities are generally identified to be: eroded sediment, organic debris, thermal effects due to decreased shade cover, and forest chemicals such as herbicides and fertilizers. The first three effects are significant in N.C. Management practices to mitigate impacts on water quality were recommended in the following activity categories: forest road construction, log decks, filter strips, stream obstructions, project close-out, site preparation and chemical application. The federal programs affecting silviculture are Agricultural Conservation Program (ACP), Forestry Incentive Program (FIP), Executive Order 11752 and National Forest Management Act (NFMA). There are also a number of state programs and laws relevant to silviculture. The Water Quality Management Plan identifies the three Best Management Practices (BMPs) which are (1) maintenance of undisturbed filter strips along streambanks, (2) proper placement and construction of access roads and skid trails, and (3) least disturbance methods of site preparation. The Plan does not specifically recommend any of the regulatory options; silviculture is a minor source of pollution in N.C., but landowners and operators should use these practices. (Iervolino-NC)
W80-01396

WATER QUALITY AND SOLID WASTE DISPOSAL: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
July 1979. 55 p, 7 Tab, 4 Fig, 18 Ref. EPA P004198010.

Descriptors: *North Carolina, *Solid wastes, *Water quality, *Water quality control, *Solid waste disposal, *Landfills, *Waste disposal, *Management, *Land management, *Solid waste disposal, Resource Conservation and Recovery Act, Erosion, Leachate, Erosion control, Impacts, Hazardous wastes, Agricultural wastes, Domestic wastes, Industrial wastes, Commercial wastes.

This report, part of North Carolina's Water Quality Management Plan, is an evaluation of solid waste management practices in North Carolina and their effect on water quality. In 1967 5 milion tons of solid waste were generated in the state; in 1968 there were 479 dump sites in the state. Solic wastes have been divided into the following categories by the N.C. Dept. of Human Resources: household wastes, commercial wastes, industrial wastes, agricultural wastes, hazardous wastes and other wastes. Adverse environmental impact of solid wastes on ground and surface waters results from leachate migration and siltation from erosion of disturbed areas. These two problems can be minimized through the proper siting, design, operation and closure of landfills. Stated are accorded a major role in solid waste management by the Resource Conservation and Recovery Act of 1976 (RCRA). The Division of Health Services (DHS) in the Dept. of Human Resources (DHR) is authorized at the state level for the regulation of solid waste disposal and is responsible for the development of the state's solid waste management plan. DHS receives planning grants annually from EPA and has permitting authority over landfill siting and operation. The N.C. General Assembly empowered the Commission for Health Services to promulgate and the DHS to enforce rules concerning the management of hazardous wastes. The Plan recommends methods to avoid leachate and erosion problems and recommends that at least one hazardous waste disposal site location and design should be completed by 1980. (Iervolino-NC)
W80-01397

OCEAN OUTFALL WASTEWATER DISPOSAL FEASIBILITY AND PLANNING.
North Carolina State Univ. at Raleigh, NC; and East Carolina Univ., Greenville, NC.; and North Carolina at Chapel Hill.
For primary bibliographic entry see Field 5E.
W80-01402

THE INFLUENCE OF CHEMICAL RECLAMATION ON A SMALL BROWN TROUT STREAM IN SOUTHWESTERN WISCONSIN,
Wisconsin Dept. of Natural Resources, Madison.
E. L. Avery.
Technical Bulletin No 110, 1978. 35 p, 8 Fig, 24 Tab, 10 Ref.

Descriptors: *Brown trout, *Streams, *Wisconsin, *Reclamation, *Antimycin A, *Fish management, *Stream improvement, Trout, Fish, Fish populations, Sport fishing, Productivity, Invertebrates, Fish control agents, Piscidides, Speciation, Biomass, Population, Chemicals, Chemcontrol, Culverts, Fish barriers.

Seas Branch Creek, Wisconsin, was treated October 1972 with antimycin A to eradicate forage fish populations consisting primarily of suckers, stonefollers, daces, and darters; maximum trout biomass increased from 72 kg/ha before treatment to 109 kg/ha after treatment. This study quantifies effects of chemical treatment and total fish removal on a domesticated brown trout (Salmo trutta) population, sport fishery, and aquatic invertebrates in a trout stream with some native trout but with moderate domestic stocking to maintain good fishing levels. After chemical treatment and installation of a culvert-type fish barrier, only 3% of the average pretreatment biomass was present above the barrier. Antimycin initially affected benthic populations. However, after two years all original 21 species were present below the barrier, while only nine species were observed above the barrier. Sport fishing declined during the two years following treatment. Fishing trip numbers increased 20% and total fishing pressure 6%, but total harvest declined 36%. Domestic trout survival did not improve following forage fish removal. Lack of permanent instream cover cuases poor winter survival rates and low stream carrying capacity. Chemical removal of forage fish is an effective management tool only whebn used in conjunction with an effective fish barrier. Greater stream productivity such as food supplies and trout habitat imply greater expected management gains. (Danovich-Wisconsin)
W80-01450

THE KINETICS OF PHOSPHATE REMOVAL IN SMALL ALKALINE LAKES BY NATURAL AND ARTIFICIAL PROCESSES,
Northwestern Univ., Evanston, IL.
D. Haumann, and T. D. Waite.
Water, Air, and Soil Pollution, Vol 10, No 3, p 291-213, October 1978. 9 Fig, 8 Tab, 33 Ref.

Descriptors: *Kinetics, *Phosphates, *Florida, *Artificial lakes, *Nutrient removal, *Lake restoration, Phosphorus, Lakes, Phytoplankton, Runoff, Fertilizers, Nutrients, Sediments, Submerged plants, Aquatic plants, Productivity, Physicochemical properties, Growth rates.

Decreasing phosphorus (P) levels in the water column by alum treatment was highly efficient

(40.8% per day) in two small artificial lakes located on a golf course in southwest Miami, Florida. Experiments September 1972-August 1974 defined rates and mechanisms which maintain low P levels, determined average nutrient uptake mechanisms and benthic macrophyte uptake capabilities, and discovered if P removal by filter-alum with sediment sealing would be sufficient to inhibit macrophyte growth. Benthic macrophytes communities use high P levels from the water column rather than from sediments. Applied P fertilizer removal rates adhere closely to two consecutive first-order reactions. Phase I, or the first few days, corresponds to high P removal rates whereas Phase II removes P at slower rates. Natural physicochemical mechanisms remove 79.7% to 97.6% P during Phase I, however, highest per-diem removal by natural processes is 11.1%. Natural removal mechanisms consist of phosphoate absorbed to dispersed calcite surface areas with slow transmutation to hydroxyapatite. Phase II P removal results primarily from hydraulic flushing and primary productivity. Filter-alum application removes P from solution at four times natural process rates through enmeshment, absorption, and isomorphic replacement of OH- by phosphate anions in a poly-metallo-hydroxy polymer. (Danovich-Wisconsin)
W80-01452

THE WATER HYACINTH: FROM PROLIFIC PEST TO POTENTIAL PROVIDER,
National Space Technology Labs., NSTL Station, MS.
For primary bibliographic entry see Field 4A.
W80-01457

FISHERIES IN LAKE RESTORATION,
Environmental Protection Agency, Washington, DC. Office of Water and Waste Management.
L. E. Keup.
Fisheries, Vol 4, No 1, p 7-9, 20, January-February 1979. 1 Fig, 1 Tab, 11 Ref.

Descriptors: *Lake fisheries, *Water pollution control, *Water quality control, *Federal government, Fisheries, Lakes, Legislation, Reclaimed water, Water resources, Water management(Applied), Limnology, Fish management, Projects, Water resources development, Planning, Contracts.

Fishery scientists need to play a role in the development and implementation of lake restoration projects, program provided for in Section 314 of the 1975 Clean Water Act and administered by the Environmental Protection Agency, in order to assure protection and enhancement of fisheries. The lake restoration program requires states to classify and identify water quality conditions in their publicly owned freshwater lakes and include procedures, processes, and methods to control pollution to eutrophic lakes and techniques to restore them. However, lake restoration is applicable to all trophic levels and all improvement aspects of the ecology of these waters. A 50% federal matching fund is available for restoration activities. Since the program began there has been little input by fishery scientists into the plans, processes, and management schemes for lake restoration projects during and after their inception. Some parts of the lake restoration program where fishery biologists could play a major role are: (1) installation of spawning beds where they do not exist or are inadequate to support a viable fishery; (2) installation of hypolimnetic aerators to maintain DO concentrations; (3) control of bottom rooting fish such as carp as an upstream watershed erosion control technique; (4) elimination of vital spawning areas by dredging a shallow area; (5) increasing spawning grounds for game fish by constructing an access to a marshy area; (6) removal of low head unused dams on tributary streams to allow upstream travel of spawning fish. (Danovich-Wisconsin)
W80-01461

OXYGENATION OF A POLLUTED LAKE IN NORTHERN ITALY,
Milan Univ. (Italy). Inst. of Geology.
G. Bianucci, and E. R. Bianucci.
Effluent and Water Treatment Journal, Vol 19, No 3, p 117-127, March 1979. 4 Fig, 6 Tab, 11 Ref.

Descriptors: *Lakes, *Italy, *Reclamation, *Aeration, *Oxygenation, *Lake Ghirla(Italy), Oxygen, Sewage, Water pollution, Water pollution control, Flow, Mixing, Movement, Water circulation, Hypolimnion, Gases, Water purification, Reaeration, Oxygen requirements, Sewage effluents, Dissolved oxygen.

After a submersed oxygenating unit introduced pure oxygen into hypolimnion layers of polluted Lake Ghirla in August 1975, dissolved oxygen (DO) in bottom water layers increased within the whole lake basin. Lake Ghirla with 0.245 sq km area, eight m mean depth, and two million cu m volume, is located in northern Italy at 442 m asl. Sewage from Valganna Town with 700 inhabitants is discharged into the river which forms Lake Ghirla; however, the lake was fairly clean until 1973 because a marsh filtered organic matter before reaching lake waters. In 1974, recreational facilities were built on the lake and the marsh's purifying capabilities were exhausted. In 1975 the lake-bed was covered with thick black putrescent mud and in 1976, swimming and aquatic sports were forbidden. When lake oxygenation operations began, there was no DO below five m. In September 1975, the oxygen curve showed two minimum values at four and nine m, with a maximum at seven m. The oxygenating device, when properly operated, does not cause layer mixing. In November 1976, electrochemical bottom sample tests show redox potential, -125 mV; pH, 6.9; color, grey; and odor, none. Oxygenation caused marked improvement since bottom sediments became partly mineralized and lost its bad smell. During summer 1977, bathing and aquatic sports were allowed. A municipal biological sewage treatment plant is being constructed and recreational facilities are also required to treat their own wastes as an ultimate solution to the lake's pollution problems. (Danovich-Wisconsin)
W80-01464

LAKES AND PHOSPHORUS INPUTS, A FOCUS ON MANAGEMENT,
New York State Coll. of Agriculture and Life Sciences, Ithaca.
D. R. Bouldin, H. R. Capener, G. L. Casler, A. E. Durfee, and R. C. Loehr.
Information Bulletin 127, (1977). 13 p, 10 Fig, 2 Tab.

Descriptors: *Water pollution sources, *Phosphorus, *Lakes, *Water policy, Impoundments, Nutrients, Management, Decision making, Sewage, Runoff, Agricultural runoff, Farm wastes, Sewage treatment, Detergents, Domestic wastes, New York, Phosphates, Social aspects.

A study of 13 central New York lakes shows that dissolved phosphorus influences productivity of freshwater lakes and impoundments, causing algal blooms, affecting fish production, and increasing water supply costs. Algal levels are determined by dissolved phosphorus, both organic and inorganic, rather than particulate phosphorus attached to soil particles. Dissolved phosphorus in these lakes comes from sewage (55%), agricultural runoff (18%), forest runoff (15%), residential runoff (6%), and atmospheric fallout (6%). Measures for controlling dissolved phosphorus inputs to lakes generally show that a ban on phosphate detergents has no cost to municipalities or agriculture (consumer costs not estimated), tertiary sewage treatment amounts to $5-12/kg P controlled, collection and treatment of unsewered populations costs $15-50/kg P controlled, and limiting barnyard runoff costs $50-150/kg P controlled. Feasibility of several policies is also discussed: (1) no action on lakes in which algae are not a problem, (2) ban on phosphate detergents, (3) tertiary sewage treatment, (4) agricultural and residential runoff control, and (5) removing all human activities from a watershed. Sociological investigations in Fall Creek watershed reveal that people are aware and concerned about water pollution; however, individual actions are not perceived as having any significant effect on the overall watershed status. (Danovich-Wisconsin)
W80-01465

TREATMENT OF AQUEOUS SYSTEMS,
CIBA GEIGY Ltd., London (England). (Assignee).
For primary bibliographic entry see Field 5F.
W80-01477

WATER PURIFICATION DEVICE AND SYSTEM,
For primary bibliographic entry see Field 5F.
W80-01488

SPILLING OIL MAY BE HAZARDOUS TO YOUR WEALTH,
For primary bibliographic entry see Field 6E.
W80-01562

OPTIONS FOR CONTROLLING NON-POINT SOURCE WATER POLLUTION: A LEGAL PERSPECTIVE,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W80-01563

THE CONTROL OF TOXIC POLLUTANTS UNDER THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972,
Iowa Univ., Iowa City.
For primary bibliographic entry see Field 6E.
W80-01567

AN ANALYSIS OF SECTION 208 OF THE FWPCA AMENDMENTS OF 1972 AND A SUGGESTED MODEL SURFACE WATER RUNOFF ORDINANCE,
For primary bibliographic entry see Field 6E.
W80-01572

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

DEVELOPMENT OF A MULTIOBJECTIVE SCREENING MODEL FOR WATER RESOURCES PLANNING IN NEBRASKA
Nebraska Univ., Lincoln. Dept. of Mathematics and Statistics.
J. P. Dauer, and J. Krueger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-111719, Price Codes: A02 in paper copy, A01 in microfiche. Nebraska Water Resources Center, University of Nebraska Project Completion Report, September 1979. 5p. OWRT A-048-NEB (1), 14-31-0001-8029.

Descriptors: *Optimum development plans, *Water resources development, *Nebraska, Computer models, Methodology, Management, Planning, *Screening model.

This project was concerned with the development of a multiobjective screening model for water resources planning. The approach used in this research was to analyze several groups of objectives. The solution structure of each individual group was produced via the method of constraints. The various groups of objective were analyzed with a goal programming approach. Particular attention was given to techniques for passing the information of one groups solution structure to the next group.
W80-01206

ECOLOGY, POLLUTION, AND BUSINESS: A PROPOSED PLANNING SOLUTION,
State Univ. of New York at Albany. School of Business.
H. Kahalas, and D. L. Groves.
Long Range Planning, Vol 11, No 6, p 62-66, December 1978. 12 Ref.

Descriptors: *Pollution abatement, *Industrial plants, Planning, Ecology, Water pollution, Legal

aspects, Regulation, Institutions, Administrative agencies, Political aspects, Social values, Governments, Industries, Management, Non-structural alternatives, James River (Va).

Pollution related issues, alternative methods of control, and their implications for business management are examined from the perspective of commercial establishments as social institutions. The complexity of the ecological problem is emphasized. While attempting to be socially responsive and still maintain an economically viable institution, the business manager must be able to differentiate basic ecological values and demands from those of a transitory nature. This is difficult because knowledge of the ecosystem and the interrelationship between its component parts is not adequate. Approaches to bring about pollution control include voluntary responses of businesses for prevention or removal of pollution such as viewing the problem as one more cost of doing business, pressure from the general public, legal suits by specialized pressure groups such as the Sierra Club, and government regulation, setting minimum standards and providing economic incentives. Various alternatives to deal with the environmental issue include application of technological solutions and management of man in his institutional setting. Overall problem complexity is illustrated by the case of kepone pollution of the St. James River, Virginia. Prevention planning based on cooperation between the public, business, government, and the scientific community is suggested as the best solution. (Luedtke-Wisconsin).
W80-01300

REGIONAL FACTORS IN THE FORMATION OF THE FISHERMAN'S PROTECTIVE UNION OF NEWFOUNDLAND,
Toronto Univ. (Ontario).
For primary bibliographic entry see Field 6E.
W80-01307

A FURTHER REVIEW OF POLLUTION CONTROL,
Newcastle Univ. (Australia). Dept. of Economics.
C. Tisdell.
Newcastle University, Research Report or Occasional Paper No 44, 1978. 28 p, 10 Fig, 15 Ref.

Descriptors: *Economics, *Water pollution control, *Pollution taxes(Charges), *Regulation, *Optimization, Taxes, Marginal costs, Graphical analysis, Mathematical studies, Mathematical models, Equations, Social impact, Social aspects, Economic efficiency.

A general review of economic pollution control measures and ways in which these measures can be combined with pollution standards concludes that no simple pollution control methods is socially optimal under all circumstances. Economists have to modify earlier inflated claims for efficiency in particular social means of control since pitfalls are inherent in many alternative pollution control approaches. Mathematical models are used to discuss Pigou's taxation approach, Coase's bargaining method, sale of pollution rights as suggested by Dale, and environmental standards enforcement method by Baumol. Market-type measures such as pollution rights and uniform taxation rates need to be modified for particular application; Tietenberg's contribution is particularly important for these methods. Ambient condition variability and uncertainty limits applicability of traditional economic policies for pollution control. Non-convexities in production possib ilities and consumption relationships are also discussed. (Danovich-Wisconsin).
W80-01309

SUBMARINE WASTERWATER OUTFALL - NEAR FIELD FLOW DYNAMICS AND MIXING,
North Carolina State Univ. at Raleigh. Dept. of Mechanical and Aerospace Engineering.
F. Y. Sorrell.
University of North Carolina Sea Grant College Program, North Carolina State University, Raleigh, Working Paper 78-4, October 1978. 35 p, 4 Fig, 2 Tab, 26 Ref, 2 Append. 04-8-MO1-66.

Descriptors: *Model studies, *Wasterwater disposal, *Flow dynamics, *Mixing *Baseline studies, *Effluents, *Outfall sewers, *Marine outfalls, *Discharge(Water), *Multiple port outfall diffusers, Models, Flow rate, Velocity, Discharge, Plumes, Ports, Outfalls, Entrainment velocity.

This study develops a model of the flow dynamics and the effluent/water mixing in the near-field of a multiple port diffuser at the end of an outfall pipe. Marine outfalls are the primary subjects of the model, which attempts to model flow behavior for most effluents. The model uses the gross-flux equations of mass momentum and buoyancy and is closed by the entrainment assumption. The interaction of the round jets from individual diffuser ports was modelled by a transition from round jets to a single two-dimensional plume. Results calculated by the model were compared with previously reported experimental data. Translating the plumes at the entrainment velocity yeilded good agreement. The dilation as computed by the model was compared with experimentally measured values over as wide a range of discharge conditions as data permitted; however, there were not a great deal of data with which to compare the model. This model does give reasonable agreement with the expriments over a wide range of discharge conditions and over the complete range of flow patterns. Dilution was slightly underestimated in most cases. The model should be a useful tool for design engineer in determining minimum mixing that will occur in discharge from marine outfalls in the southeastern coastal waters. (Arnold-NC)
W80-01387

COST OF CONTROLS FOR 'SMALL HYDRO-ELECTRIC PLANTS' OR RIVER SYSTEMS,
Oregon State Univ., Corvallis. Dept. of Electrical and Computer Engineering.
P. A. Frick, and G. C. Alexander.
Available from the National Technical Information Service, Springfield, VA 22161 as DOE-ET-283101, Price codes: A07 in paper copy, A01 in microfiche. Final Report to U.S. Department of Energy. Report No DOE/ET/28310-1, February 1979. 124 p, 29 Fig, 11 Tab, 4 Append, 2 Ref. E6-77-S-07-1690.

Descriptors: *Hydroelectric power *Projects, *Hydroelectric plants, *Dams, *Costs, *Engineering structures, *Hydraulic turbines, *Flow control, Impoundments, Water resources, Electric generators, Electric power, Water utilization, Operating efficiency, Reservoirs, Turbines, Dam design, Multiple purpose projects, Structures.

This study analyzes the problems and costs of water power control by different types of single unit and multiple unit small hydroelectric power plants. Two plant models presented are a relatively large dam flow model with water flow through a large sluice and design discharge of about 12,000 cubic feet per second (cfs) and a small variation dam model, with design discharge of about 230 cfs. A trapezoidal shaped model dam is derived from these and proposed as an efficient example of small project hydropower generation at a cost savings. The authors conclude that there are no significant cost advantages of using a continuous (base load) means of operation of the plant over intermittent (peak load) operation. It is asserted that maximum efficiency is more readily attained by adjusting the dam's turbine blade angle than by adjusting the wicket gates alone. Finally, a comparison of various motor and telemetry modules to control small hydroplant operation reveals that units with controllable turbine runner blades are necessary for operation; and that highly sophisticated, or 'intelligent' dam operation controlling modules are not yet feasible from a cost point of view, but that future research should provide such a unit usable in small hydroelectric installations. (Arnold-NC)
W80-01388

PROCEEDINGS: STORMWATER MANAGEMENT MODEL (SWMM) USERS GROUP MEETING, NOVEMBER 13-14, 1978.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 742, Price codes: A11 in paper copy, A01 in microfiche. Environmental Protection Agency, Washington, DC., Miscellaneous Report Series. Report No EPA-60/9-79-003, November 1978. 238 p. EPA R-802411, R-805664.

Descriptors: *Mathematical models, *Urban hydrologic models, *Storm water, *Storm runoff, *Computer models, *Stormwater Management Model(SWMM), *Water management(Applied), Combined sewers, Runoff, Hydrology, Urban hydrology, Combined sewer overflows, Water pollution control, Detention basins, Flood control.

This report includes ten papers on various model-related topics presented at the semi-annual joint U.S.-Canadian Stormwater Management Model (SWMM) Users Group Meeting, held in November 1978 in Annapolis, Marylnd. One paper describes the revised SWMM Storage/Treatment model which is much more flexible than earlier versions in terms of the control units available, the pollutant routing and cost estimating. Also included in this report is a description of stormwater modelling applications in Ontario and case studies of stormwater management systems using SWMM in Cincinnati, Ohio and other locations in Ohio. Several articles describe the background, framework and applications of different stormwater modelling techniques and computer package programs. One such program is RAFFI which is newly devised and can be combined with STORM. RAFFI is a simple model which provides hourly information on flows and pollutants (BOD and SS) diverted into receiving waters from various overflow points, and treatment and by-pass operations at the plant. Other topics covered in this report are papers on computer simulation of flood relief works utilizing inlet control and detention storage, and analysis of detention basin systems, presentation of a pre-and post-processing program package for the SWMM called FASTSWMM, a methodology for evaluating agricultural best management practices (BMPs), and model applications in facility planning. (Iervolino-NC)
W80-01389

OPTIMAL ALLOCATION OF WATER FOR RURAL AND URBAN USE IN DEVELOPING COUNTRIES WITH SPECIAL REFERENCE TO IRAN,
Aston Univ., Birmingham (England), Management Centre.
K. Vaidya, and V. A. Tavokoli.
I.T.C.C. (International Technical Cooperation Centre) Review, Vol VIII, No 1(29), p 1-19, January 1979, 7 Fig, 7 Tab, 6 Ref.

Descriptors: *Water demand, *Models, *Mathematical models, *Water supply, *Planning, *Water supply development, *Water allocation(Policy), Water utilization, Iran, Tehran(Iran), Water sources, Reservoirs, Storage, Aquifers, Agricultural uses, Irrigation, Water pricing, Water policy, Water allocation, Water resources development.

Rapid growth of urban populations in developing countries has put a severe strain on many of the available resources, including water. Here, the authors consider the problem for Tehran and surrounding agricultural areas for the next 10 years. A mathematical programming model is developed to explain the optimum allocation function possibilities for water supply in the Greater Tehran Area (GTA), with respect to individual, commercial, industrial, and agricultural uses. Although major new water resource projects are bing built these alone will not meet the area's consumptive water needs for more than a couple of decades. The mathematical demand model first expresses urban demand as a function of per capita use and total/area population. Between 1960 and 1973, urban consumption of water rose 500%, although population barely more than doubled. The main objective demand function expresses use and demand as related to storage and flow capabilities of existing sources/reservoirs servicing the urban area. Major function constraints include reservoir and aquifer storage capacity, amounts lost through reservoir seepage and evaporation, and the portions of the river basins with as yet uncontrolled flow. Conclusions indicate that the area's demand will increase

over 60% in the next 10 years, and thus varying optimum shift of water supply by season and developing different pricing policies for urban and rural areas are recommended. (Arnold-NC)
W80-01407

A MODEL FOR THE ANALYSIS OF SEASONAL ASPECTS OF WATER QUALITY CONTROL,
Hebrew Univ., Jersalem (Israel); and Chicago Univ., IL.
D. Yaron.
Journal of Environmental Economics and Management, Vol 6, No 2, p 140-151, June 1979, 2 Tab, 24 Ref.

Descriptors: *Water quality control, *Water quality, *Mathematical models, *Cost analysis, *Linear programming, *Water pollution, *Discharge(Water), *Pollutants, *Seasonal models, River basins, DuPage River(IL), Streamflow, Effluents, Cost functions, Biochemical oxygen demand, Low-flow augmentation, Effluent standards.

This article presents a multiseasonal mathematical model for analysis of water quality control within a river basin, using the DuPage River Basin of Northeastern Illinois. Using one year as the basic unit of time, and dividing the basin into a given number of reaches with 60 gauging stations, pollutant concentration at any one station is expressed as a function of the level of production of each discharger, the quantity of pollutant discharged, maximum amounts of pollution by a given number of waste treatment plants, and the level of pollutant removal by each plant. 'Transfer coefficients' indicate the level of reduction in water quality due to a discharge of one unit of pollution into that reach of the river, expressed as ((mg/liter)/lb); these play a central role in expression of the function. The model has implications for its usefulness in determining the level of taxation, or charge, which should be levied on polluters, as well as helping to evaluate possible savings in water pollution abatement costs using river flow control by means of reservoirs (low-flow augmentation). Other findings from model application indicate that the marginal social cost of biological oxygen demand (BOD) varies significantly from one season to the next, particularly from a high-flow to a low-flow season, and that allowing for a higher effluent standard during the high-flow season can result in a significant cost savings. (Arnold-NC)
W80-01408

A METHOD FOR ESTABLISHING A WATER QUALITY INDEX FOR DIFFERENT USES (IQE),
Environmental Protection Services, Montreal (Quebec). Bureau of Toxic Substances.
M. Provencher, and M. P. Lamontagne.
July, 1979. 234 p, 17 Charts, 15 Tab, 40 Ref, 5 Append.

Descriptors: *Water quality, *Mathematical models, *Models, *Water management(Applied), *Water quality parameters, Baseline studies, Quebec, Water resources management, Analytical techniques, Methodologies, Data processing.

This report presents the various stages in developing a water quality index (IQE), as well as its possible applications. The IQE is a mathematical method of determining the quality of a given stretch of water in terms of a given use, with a number rating of 0 to 100. Three special types of needs were taken into account--industrial, social and ecological. Three categories of water quality were used--chemical, biological and physical characteristics--and for each category of use, a set of weighted parameters is assigned. Six computer subroutines were used to input data in order to assess the characteristics of the quality evaluation function under different conditions with different combinations of parameters. Categories of water use, such as drinking, cooling, and industry, were compared to their respective percentage use of the total water supply. Data processing was found to be both rapid and simple. The Index, which can be calculated for 17 categories, has a fairly wide field of application. The method should be useful for several purposes--to prepare relative classifications of different bodies of water, to determine changes in water quality in space and time scale; it could be a useful tool in carrying out technical studies of the aquatic environment, in establishing an indicator for incorporation into directories and data banks, and in providing information on water quality. (Arnold-NC)
W80-01409

THE INTERDEPENDENCE OF WATER, ENERGY AND ECONOMIC DEVELOPMENT IN NEW ENGLAND'S FUTURE: A SYNOPSIS OF THE WORKSHOP, OCT. 27-28, 1977,
New England River Basins Commission, Boston, MA.
E. Kaplan, R. W. Hardy, and J. S. Munson.
Brookhaven National Laboratory, Informal Report 24788, August 1978. 55 p, 10 Ref, 4 Append. USDE EY-76-C-02-0016.

Descriptors: *New England, *River basins, *Comprehensive planning, *Water policy, *Planning, *Regional analysis, Northeast US, River basin commissions, River basin development, Water resources development, Economics, Energy, Nuclear energy, Attitudes, Institutional constraints.

Water resources, energy and economic development are inseparable components for policy analysis in multistate regional planning for river basins, and any analytical methodology which omits one or more of these interacting elements will produce misleading results; nevertheless, no such comprehensive methodology is presently available for application to the New England region or any other U.S. sub-national area. This regional workshop, organized as a first step in developing a systematic and coherent research strategy for analyzing technological, economic and institutional factors governing the dynamic relationships between water use, electric power generation and economic development patterns in New England, also concluded: (1) Institutional issues are central to most energy/water/economic development conflicts and must be incorporated in any comprehensive regional analysis and assessment methodology. (2) Study factors which should be included are centralization vs. decentralization; implications of scale; conservation and rapid industrialization; institutional implications; public attitudes; accountability; evaluation techniques; data bases and technological implications. Workshop papers covered: (1) public attitudes toward nuclear power; (2) regionalism and economic development; (3) institutional factors in New England power production; (4) water resources as a New England siting determinant; (5) technological considerations; (6) impact evaluation; and (7) modeling of regional economies. (Harris-Wisconsin)
W80-01466

TRANSFRONTIER POLLUTION IN INTERNATIONAL WATER BASINS,
Eidgenoessisches Amt fuer Umweltschutz, Bern (Switzerland).
For primary bibliographic entry see Field 6E.
W80-01473

6B. Evaluation Process

PLANNING FOR WATER USE IN MINNESOTA,
Minnesota Univ., St. Paul. Dept. of Agricultural and Applied Economics.
J. J. Waelti, and R. L. Gardner.
Minnesota Agricultural Economist, No 583, October 1976, Agricultural Extension Service, University of Minnesota. 8 p. OWRT-A-031-MINN (6).

Descriptors: *Water utilization, *Planning, *Minnesota, *Irrigation, Agriculture, Water supply, Water demand, Available water, Regional development, Evaluation.

Crop losses, as experienced in dry years such as 1976, draw renewed attention to problems of water management in Minnesota. In a year of heavy farm losses, attention focuses on irrigation and agricultural uses of water. Use of water for agriculture, however, is just a portion of the total water management picture. Water, as any resource in limited supply, has a number of alternative and competing uses. Society must make decisions regarding the use and management of the limited resource. There must be planning and management on a statewide basis toward rational decisions regarding use of limited water supplies. This article is concerned with some of the planning effort relating to water resources and current issues relating to water management and use in Minnesota. (Blake-Minn)
W80-01264

ECONOMIC GRATIFICATION ORIENTATION AMONG SMALL-SCALE FISHERMAN IN PANAMA AND PUERTO RICO,
Rhode Island Univ., Kingston Dept. of Anthropology.
R. B. Pollnac, and J. J. R. Poggie,.
Human Organization, Vol 37, No 4, p 355-367, 1979. 2 Fig, 3 Tab, 38 Ref.

Descriptors: *Puerto Rico, *Commerical fishing, *Social adjustment, *Social aspects, *Social needs, *Anthropological aspects, Fisheries, Economics, Economic impact, Community development, Investment, Social impact, Budgeting, Income analysis, Correlation analysis, Variability, Regression analysis, *Panama.

Fishermen in Panama and Puerto Rico indicate strong situational components influencing differential patterning of gratification determinants. Periodicity, relative security, optimism, and opportunity structure generally influence gratification orientations. Subsample differences indicate that perceived socioeconomic progress, age, fishing income, boat ownership, and having a fishermen father are situationally influenced gratification determinants. This paper determines the effects situational differences have on both economic gratification orientation correlates and interrelationships between those correlates. Data are based on interviews with 123 small-scale Panamian fishermen and 11 adult Puerto Rican males (50 of them are fishermen). Economic gratification parameters were correlated with age, occupation, income, self-evaluation of socioeconomic position, optimism-pessimism, material culture, production ownership, education, media exposure, and urbanization. Results emphasize that in order to understand multiple determinants in regional developmental progress, subregional variation with respect to the sociocultural environment must be taken into account. Age is related to economic gratification orientations only in Panamanian urban areas; older fishermen are more deferred than younger. Panamanian urban subsample correlation analysis indicates that older fishermen have been fishing longer, are more likely to own their own home and boat, and are more optimistic about their future status, all indicators of security. (Danovich-Wisconsin)
W80-01301

COST BENEFIT ANALYSIS AND THE DETERMINATION OF BEST ENVIRONMENTAL OPTIONS,
D. C. Lewis.
Warwick University, Discussion Paper No 12, August 1978. 37 p, 4 Fig, 32 Ref.

Descriptors: *Costs, *Cost-benefit analyses, *Environmental effects, *Optimization, *Benefits, Marginal costs, Economics, Decision making, Water policy, Management, Damages, Water pollution, Water pollution control, Air pollution, Pollutants, Project planning, Governments.

A major inadequacy in many economic studies of air and water pollution problems is that the benefit side of cost-benefit analyses received scant attention. Where a recreation site is planned, plausible estimates of monetary benefits can be made. However, if the proposal includes installation of pollution control devices, complex damage estimates for different pollutants makes traditional cost-benefit techniques impractical. A cross-media evaluation methodology, adopted by Battelle Columbus Lab-

oratories, is a realistic appraisal of various environmental benefits if substantial amendments are employed. The following changes are proposed: allow experts to evaluate dispersion range, transferability, and persistence; extend the Delphi technique to allow experts to evaluate damage functions for each pollutant; modify the Delphi technique allowing brief statements explaining reasons for evaluations; use straight relative weighting of relevant pollutants rather than a two-stage weighting system; add phrase questions about different pollutants in terms of marginal rather than total emissions. Where cost-benefit analyses are impractical, environmental indices may be used. Overall, restraint must be exercised in searching for economic optimality. While economic techniques can be employed in many areas, one must always compromise with reality and compare alternatives that are institutionally feasible. (Danovich-Wisconsin)
W80-01302

GROWTH, TECHNOLOGY TRANSFER AND THE ENVIRONMENT,
Leicester Univ. (England). Dept. of Economics.
S. Ghatak.
Indian Journal of Economics, Vol 59, No 23, p 73-85, July 1978. 3 Fig, 35 Ref.

Descriptors: *Pollution abatement, *Technology, *Economic growth, *Environmental effects, Regional development, Regional economics, National income, Gross national product, Economics, Model studies, Political aspects, Area redevelopment, Governments, Technology, Research and development, Information exchange, *Underdeveloped countries, *Developed countries, *Developing countries, *International economic development.

Arguments are presented to show that the interaction between growth by means of technology transfer and the environment is important not only for developed countries (DCs) but also for less-developed countries (LDCs). The paper also develops a simultaneous equation model to estimate effects of technology transfer and of growth on pollution as well as the effects of technology transfer on growth and investment. Although environmental assimilative capacities of LDCs are generally greater than those of DCs, three factors suggest that interactions of the environment-development process should be examined for all countries: (1) If global pollution is a threat to health, then it behaves as a public 'bad' universally and is a problem as much for DCs as for LDCs. (2) Because of transfrontier externalities no single nation can set a private national optimum level of pollution. (3) LDCs need not necessarily experience the same pattern of pollution-causing technological change to support their growth as was borne by today's DCs. In the models developed here, estimations are made of the process of development by increasing output per capita; environmental degradation is treated as a cost to be borne in the process. The issue for LDCs is to find the minimum social cost path and such a path is analyzed with the model. (Harris-Wisconsin)
W80-01306

A FURTHER REVIEW OF POLLUTION CONTROL,
Newcastle Univ. (Australia). Dept. of Economics.
For primary bibliographic entry see Field 6A.
W80-01309

THE ECONOMIC IMPACT ANALYSIS OF EFFLUENT STANDARDS FOR TOTAL DISSOLVED SOLIDS,
Illinois Inst. of Natural Resources, Chicago.
L. L. Huff.
Illinois Institute of Natural Resoures, Document No 78/12, October 1978. 77 p, 3 Fig, 16 Tab, 4 Append.

Descriptors: *Effluents, *Dissolved solids, *Water quality standards, *Economic impact, *Cost-benefit analysis, Costs, Economics, Industries, Economic efficiency, Environmental effects, Discharge(Water), Water pollution, Regulation, Water quality, Illinois, Electric powerplants, Municipal water, Water pollutions sources, Benefits.

Elimination of the present total dissolved solids (TDS) effluent standard in Illinois is warrented considering the magnitude of point source versus non-point source contributions and economic impacts. The present standard is 750 mg/l; waste treatment and recycle plants are allowed 3500 mg/l. In 1977 and 1978, 1% of samples collected exceeded TDS water quality standards. Highest TDS levels are recorded in mining areas and northeastern Illinois. Average TDS leaving the state via seven rivers is 44,100,000 lb/d; 65% of this results from storm water runoff. Background from industrial groundwaters and direct industrial discharges account for only 15% TDS state load. Increased operating costs in residential, industrial, and power generation water users due to scale formation from minerals amounts to $231,000 per year if standards are eliminated. Land repeatedly irrigated with water containing high TDS reduces crop yield. Vegetation and wildlife are harmed with TDS levels over 1500 mg/l. Laxative effects and unpleasant taste occur in high TDS water. Quantitative cost assessment for agriculture, ecology, and human health effects is zero. Standard elimination benefits potable water treatment plants, electric generating stations, and industrial discharges. Total annual savings in analytical and treatment costs amount to $1 million to $8.2 million if standards are eliminated. (Danovich-Wisconsin)
W80-01310

ASSESSMENT OF THE ECONOMIC AND SOCIAL IMPLICATION OF WATER QUALITY IMPROVEMENTS ON PUBLIC SWIMMING,
Battelle Columbus Labs., OH.
J. L. Moore, D. E. Perin, and B. G. Maiden.
Report to National Commission on Water Quality, February 19, 1976. 107 p, 10 Fig, 27 Tab, 4 Append. WQAC013.

Descriptors: *Water quality, *Beaches, *Recreation, *Swimming, *Federal Water Pollution Control Act, Recreation facilities, Coliforms, Sewage, Sewage bacteria, Water pollution, Public health, Water pollution control, Pollution abatement, Cities, Water quality standards, Mathematical models, Model studies, Equations, Cleveland(OH), St. Petersburg-Tampa(FL), Rockford(IL).

At best, 86% of the public and private beaches forced to close due to poor water quality may be improved by the 1972 Federal Water Pollution Control Act Amendments. A survey of 38 public health agencies in all costal and Great Lakes states and 10 island states found 13% to a total of 3,521 beaches constrained or closed because of water quality problems. For public beaches, 3-8% of national by ac reage is constrained by degraded water quality. 39% of the closings were for less than two weeks, however, 14% of the beaches are permanently closed. The majority occur in or near metropolitan areas; 72% are due to high coliform or fecal coliform counts, which indicate possible intestinal parasites or pathogens. Improper sewage disposal causes high coliform counts. Water quality improvements could increase present seasonal recreational swimming 1.2-2.7% and also produce a shift (8-28%) in outdoor swimming locations opened as a result of improved quality. Gains in recreational swimming facilities will be primarily in urban areas. A model estimating recreational gains was tested on three areas: Cleveland, Ohio; St. Petersburg, Tampa, Florida, and Rockford, Illinois. The Act may result in a minimum increase of six million annual activity days and a 7.4 million gain by 1983. (Danovich-Wisconsin)
W80-01314

ECONOMIC AND LEGAL ENFORCEMENT MECHANISMS.
For primary bibliographic entry see Field 6E.
W80-01467

TENNESSEE VALLEY AUTHORITY'S USE OF RECREATIONAL BENEFITS IN RESOURCE ALLOCATION FOR MULTIPLE-PURPOSE WATER RESOURCE PROJECTS,
Tennessee Univ., Knoxville.
W. H. Hedley.
M Sc Thesis, December 1977. 67 p, 1 Fig, 21 Tab, 30 Ref.

Descriptors: *Benefits, *Tennessee Valley Authority, *Multiple purpose projects, *Recreation, *Resource allocation, Cost-benefit analysis, Federal project policy, Multiple-purpose reservoirs, U.S. Army Corps of Engineers, U.S. Soil Conservation Service, Economic evaluation, Economic justification, Federal government.

Comparison of demand and value measurements made by the Tennessee Valley Authority and by various federal agencies in establishing recreational benefits of government-built water resource projects shows that each agency complies with federal requirements that benefits and costs of recreation opportunities be measured by and accounted for in agency justifications of the projects. However, the investigation shows that TVA, the U.S. Army Corps of Engineers and the Soil Conservation Service all used different methodologies to conform with the regulations. Recommendations derived from the investigation: (1) Standardized methods should be developed for determining the value of water-based recreation benefits. (2) Methodologies should be developed to determine the most accurate standard criteria for demand and value measurements. (3) Procedures are needed to determine which estimated recreational benefits are most accurate. For example, 5-10 yr intervals could be used to check the validity of recreational benefit projections. (4) Criteria used in determining the demand and value measurements should be verified by further field studies at the reservoirs in question. (5) Standardized criteria and procedures for analyzing data should be formulated to single out pertinent information for more accurate recreational benefit projections. (Harris-Wsiconsin)
W80-01469

THE SOCIAL AND POLITICAL MATRIX OF ENVIRONMENTAL ATTITUDES. AN ANALYSIS OF THE VOTE ON THE CALIFORNIA COASTAL ZONE REGULATION ACT,
Pennsylvania State Univ., University Park. Div. of Man-Environment Relations.
J. F. Wohlwill.
Environment and Behavior, Vol 11, No 1, p 71-85, March 1979. 2 Tab, 8 Ref.

Descriptors: *California Coastal Zone Regulation Act, *Attitudes, *Social values, *Correlation analysis, Public opinion surveys, Psychological aspects, Regulation, Zoning, Coastal zone management, Non-structural alternatives, Social aspects, Political aspects, Legislation, California, State jurisdiction, Coasts, Pacific Ocean.

Among numerous state-wide referenda included on the ballot in California for the 1972 general election in November was Proposition 20, the California Coastal Zone Regulation Act. This legislation, which became the focus of statewide pro- and anti-environmentalism controversy, provided that a strip of land adjacent to the state's Pacific shoreline would be subject to comprehensive planning and rigid controls, regardless of private property ownership. The act passed with about 55% of the vote. Intercorrelations between Proposition 20 and other votes shows: (1) Pro-environmental attitudes are positively related to political and social liberalism. (2) Environmental attitudes do not form a unitary and homogenous entity. (3) Environmental attitudes are only partially dependent on social or political values. Demographic correlates of the vote on Proposition 20 show: (1) Support of coastal zone controls is more related to educational level than to income. (2) Even for communities along the shore, there is not a clear association between home ownership and the Proposition 20 vote. (3) Voters living some distance from the coast are somewhat less likely to support the zoning act than those residing close to the shore. (4) There is no evidence that persons residing close to the shore oppose zoning controls because of any real or imagined sense of proprietary rights. Generally, results show that environmental concerns as expressed in the polling booth are based on deliberate decisions confronting the voter, while political and social attitudes are gratuitous expressions of opinion. (Harris-Wisconsin)

W80-01470

A SURVEY RESEARCH EVALUATION OF CITIZEN PARTICIPATION STRATEGIES,
Massachusetts Univ., Amherst. Water Resources Research Center.
M. O. Ertel.
Water Resources Research, Vol 15, No 4, p 757-762, August 1979. 5 Tab, 8 Ref. OWRT B-050-MASS (2), 14-31-0001-6086.

Descriptors: *New England, *River basin commissions, *Evaluation, *Public participation, Planning, Water resources, Surveys, Effects, Research, Data, Public meetings, Public reaction.

The New England River Basins Commission has utilized communication strategies designed to stimulate public involvement in the planning process of three 'level B' studies. The effectiveness of these strategies, including agency-produced printed information, use of the mass media, personal staff contact, and public meetings has been evaluated by means of questionnaires administered to members of the public who attended the final public meetings conducted in each study. The implications of the research findings for more effective functioning of citizen participation programs are discussed. (Bell-Graf--Cornell)
W80-01542

FUTURE EFFECTS ON THE MINING INDUSTRY OF 1977 CLEAN WATER ACT,
Kennecott Copper Corp., Salt Lake City, UT.
I. G. Pickering.
Mining Congress Journal, Vol 65, No 2, p 75-77, 80, February, 1979.

Descriptors: *Water pollution control, *Economic impact, *Mine wastes, *Mineral industry, Mining, Legislation, Environmental control, Federal Government, Administrative agencies, Administrative decisions, Regulations, Cost-benefit analysis.

In the proposed National Pollutant Discharge Elimination System (NPDES) revisions, the federal Environmental Protection Agency (EPA) has shown clearly its intention to propose the most stringent controls possible on every pollutant discharge from each industrial plant. This intention is demonstrated in the 1977 Clean Water Act (C.W.A.). The mining industry may expect the most stringent application of water pollution control that EPA can maintain. The industry must prepare for 'worst case' interpretation from EPA. Standards will be ever moving environmental targets as standards are set and later revised. A zero discharge concept markedly more severe than anticipated looms on the horizon. C.W.A. regulations may curtail existing mining operations and create cost roadblocks for opening new mines. To remain a viable, productive force in this country, the mining industry must make a reasonable profit and return on investment. If the government continues to require the industry to commit its assets to pollution control until it is a breakeven or failing, the industry will not continue to exist. (Ewing-Florida)
W80-01575

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

AN ECONOMIC ANALYSIS OF COST SHARING ARRANGEMENTS IN WATER AND RELATED LAND RESOURCES
Montana State Univ., Bozeman. Dept. of Agricultural Economics.
H. Holje.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-112410, Price codes: A01 in paper copy, A01 in microfiche. Montana Joint Water Resources Research Center Montana State University, Research Report Number 101, October 1979. 60 p, 30 Ref.

Descriptors: Water resources, *Economics, *Cost sharing, Cost benefit analysis, Water resources development, Federal government, State governments, Systems of accounts, Opportunity costs, Cost sharing options.

This report is primarily a historical review and philosophical essay of cost sharing issues, options and policies as they pertain to the development, financing and management of our Nation's water resources. A brief review is presented of the more important legislative acts dealing with economic evaluation, cost allocation and cost sharing. This is followed by an analysis of the problems facing our various governmental units in establishing an equitable and efficient cost sharing system. It is quite clear that the present Administration has stressed the fact that all future water resources developments will come under much closer scrutiny in the future, both in terms of evaluation and cost sharing policies. This is well illustrated by the so-called 'hit list' that developed early in the present Administration. With the strong inflationary trends of the present-day and the feeling that greater support should be provided by state and local governments it is fairly evident that the days of highly subsidized developments by the Federal government are coming to an end. Without question, this means that state and local governments, as well as private beneficiaries, are going to have to develop new methods for financing water resource developments if they feel these developments are essential to their economic welfare. (Hunt-Mont)
W80-01204

COSTS AND RETURNS FOR PRODUCING CATFISH FINGERLINGS,
R. E. Allain, and W. R. Morrison.
Arkansas Agricultural Experiment Station Bulletin, No 831, p 3-24, November 1978. 2 Fig, 13 Tab, 4 Ref.

Descriptors: *Agriculture, *Costs, *Catfishes, Fish farming, Economics, Prices, Investment, Return(Monetary), Economic efficiency, Model studies, Profit, Comparative costs, Capital costs, Operating costs, Facilities, Equipment, Economies of scale.

Costs of providing a constant monthly number of catfish fingerlings for sale to maintain orderly marketing is studied. Using the best available production technique, general techniques are to estimate investment requirements, annual costs, monthly unit catfish fingerling farms. Estimated investments in land, levees, pumping plants, plumbing, broodfish, buildings and equipment total $244,265 for an 80 acre farm and $423,443 for a 160 acre farm. Estimated total annual costs for the small farm are $124,802 and $208,643 for the large farm. Economies of size result in a more favorable cost per fingerling in any given month for the large farm. Monthly gross returns are estimated by two pricing methods yielding $15,000 under constant-unit pricing and $15,000 to 20,000 under margin pricing for the small farm and $30,240 to $35,280 respectively for the large farm. Net returns for the 80 acre farm are estimated at $1,559 to $6,585 per month under constant unit price and $5,309 to $6,585 under margin pricing, while the 160 acre farm nets $9,256 to $15,706 and $14,296, to $15,706. Investment pay back periods range 2.3 to 5.1 years depending on the investment and net return used. Cash needs for the annual ongoing operation are estimated at $94,310 and $158,166 for the small and large farm respectively. (Luedtke-Wisconsin)
W80-01303

ECONOMIES OF SCALE IN SEWAGE PURIFICATION AND DISPOSAL,
M. R. J. Knapp.
The Journal of Industrial Economics, Vol 27, No 2, p 163-183, December 1978. 2 Fig, 3 Tab, 45 Ref.

Descriptors: *Sewerage, *Regression analysis, *Economies of scale, *Costs, Sewage treatment, Sewage disposal, Economics, Planning, Pricing, Statistical analysis, Model studies, Optimization, Equations, Operating costs, Biochemical oxygen demand, Flow, Suspended solids, *United Kingdom.

This empirical study of sewage purification and disposal costs of 172 British facilities March 1972-1973 reveals strong and pervasive economies of scale over broad output value ranges. Statistical cost functions with least-squares regression techniques are used. Study findings are tempered by conceptual gaps: capital costs are omitted; price and technology variable are not adequate; estimated average cost fluctuations represents short-run cost-output only; and weekly, daily, and hourly fluctuations in sewage flow are omitted. Production levels are measured by total volume of sewage treated daily to degree of purification. Average operating costs form an L-shaped curve when plotted against output, implying significant scale economies by operating sewage purification and treatment works in lower output ranges up to 10 million gallons daily, but few economies thereafter. In larger works, diffused air activated sludge and vacuum mechanical dewatering methods raise costs and land treatment of final effluent lowers average costs. The basic average cost curve is a simple hyperbolic function of daily flow. Two other variables which are significant average operating cost predictors are: proportions of biochemical oxygen demand removed during purification and the average strength of influent as measured by suspended solids content. Scale diseconomies in collection and transmission costs depend upon population density, local topography, and treatment facility location in the area. (Danovich-Wisconsin)
W80-01305

ENERGY REQUIREMENTS OF PRESENT POLLUTION CONTROL TECHNOLOGY,
Monsanto Research Corp., Dayton, OH.
R. W. Serth, and R. S. Hockett.
Report EPA-600/7-78-084, Interagency Energy/Environment R & D Program Report, May 1978. 90 p, 8 Fig, 35 Tab, 74 Ref, 2 Append. 68-02-1320.

Descriptors: *Water pollution control, *Pollution abatement, *Energy, *Cost analysis, Electric powerplants, Industrial plants, Iron, Steel, Treatment facilities, Waste water treatment, Solid wastes, Waste disposal, Environmental engineering, Regulation, Industrial wastes.

About two percent of total annual U.S. energy consumption, about 1.7 quads, are required to meet government regulations for pollution control at stationary sources in 1977. These values represent operating energy only; an additional 0.2 quad would be needed for fabrication and installation of the pollution control equipment. Projections for the mid-1980s indicate that the percentage energy requirement for stationary-source pollution control will increase only slightly to 2.5-3.0 percent of U.S. 1985 energy consumption. For 1977, the source breakdown of pollution control energy requirements are: (1) 58 percent for industry; (2) 20 percent for powerplants; (3) 16 percent for municipal wastewater treatment plants; (4) 6 percent for solid waste disposal. Of the industrial pollution control energy requirement, about 80 percent is for seven industries: paper; primary metals, chemicals, petroleum; fabricated metals; stone, clay and glass, and foods. Of these seven industries, primary metals alone accounts for more than one-third the energy total. Iron and steel production requires about 70 percent of the pollution control energy among the primary metals, and this sub-industry accounts for 25 percent of the energy requirement in the general industrial sector and about 15 percent of the requirement from among all stationary sources. Alternative pollution control methods which require less energy but which still satisfy environmental regulations and standards are also discussed. (Harris-Wisconsin)
W80-01311

ECONOMIC ANALYSIS OF TECHNOLOGY TO COMPLY WITH P.L. 92-500 GROUP A INDUSTRIES.
National Planning Association, Washington, DC.
I. Gutmanis, R. P. McKenna, and D. Paul.
Report prepared for National Commission on Water Quality, August 1975. 6 Fig, 29 Tab, 7 Ref.

Descriptors: *Costs, *Technology, *Industries, *Water quality standards, *Water quality act, Economics, Water quality, Regulation, Water pollution control, Pollution abatement, Effluents, Capi-

tal costs, Operating costs, Maintenance costs, Pulp and paper industry, Laundering, Industrial production, Economic impact, Fish farming, Construction materials, Soaps, Detergents, Paints, Steam, Roofing materials, Lumber, Concrete, Asbestos.

This final economic report focuses on 'A' industries, which are relatively minor polluters, and costs and technology available to comply with the Water Quality Act. The study covers (1) timber products, (2) fish hatcheries and farms; (3) furniture and fixtures; (4) soap and detergents; (5) paint and ink formulations and printing; (6) paving and roofing materials; (7) glass; (8) structural clay; (9) pottery and related products; (10) concrete, gypsum and plaster products; (11) asbestos products; (12) insulation fiberglass; (13) auto and other laundries; and (14) steam supply industries. The soap and detergent manufacturing sector is taken as an example. It is divided into several subcategories: soap, synthetic organic detergents, inorganic alkaline detergents, and other crude oil and natural oil combinations. In 1968, 30.6 billion gal water were used; 19.7 billion gal were discharged. The industry is not a major polluter; its discharges are non-toxic and pose no serious threat to aquatic life. Most plants are situated in well-developed, industrialized areas and 95-98% use municipal sewer systems. The approximate maximum investment (I) BPT costs for small soap plants are $2.1 million with $155,000 operating and maintenance (O&M) costs, for small liquid detergent plants $3.2 million (I) and $219,000 (O&M), and for large integrated soap and detergent plants $1.2 million (I) and $92,400 (O&M). The overall cost to the industry is relatively small compared to their income and expenses. (Danovich-Wisconsin)
W80-01312

ECONOMIC ANALYSIS OF TECHNOLOGY COSTS TO COMPLY WITH P.L. 92-500 GROUP B AND C INDUSTRIES,
National Planning Association, Washington, DC.
Report prepared for National Commission on Water Quality, November 1975. 282 p, 1 Fig, 165 Tab.

Descriptors: *Costs, *Industries, *Technology, *Water quality act, *Water quality standards, Regulation, Water pollution control, Water quality, Pollution abatement, Economics, Sugar beets, Sugarcane, Transporation, Oil industry, Food processing industries, Canneries, Commercial fishing, Construction, Rubber, Construction materials, Effluents, Capital costs, Operating costs, Maintenance costs, Economic impact.

This publication focuses on Group B and C industries or relatively major polluters, and costs and technology available for complying with the Water Quality Act. The study covers (1) petroleum and gas extraction; (2) beet sugar; (3) cane sugar; (4) canned and preserved seafood processing; (5) brewing; (6) builders paper products; (7) rubber processing; (8) ferroalloys and calcium carbide industries; and (9) transportation. Water pollution control technology for the petroleum and gas extraction industry includes reinjection, plate coalescers, and flotation cells. Whether economic impacts from pollution abatement costs will be deleterious depends largely upon oil prices. Water pollution control technology for cane sugar manufacturing includes filter cake slurry disposal, processed water and complete treatment. Total annual costs (investment and operation and maintenance) for liquid cane sugar facilities are $1.3 million for 366,000 tpy output; for large crystalline refineries, $438,451 is required, (381,000 typ output). Four basic technological options are available for the builders paper manufacturing industry; activated sludge or serated stabilization basins (ABS), followed by retention and landfill or incineration. For the industry the capital $/ton output and O&M $/ton amount to 20.12 and 1.64 for activated sludge and incineration, 14.45 and 1.42 for activated sludge and landfill, 17.35 and 1.24 for ABS, retention, and incineration, and 11.92 and 0.99 for ABS, retention, and landfill, respectively. (Danovich-Wisconsin)
W80-01313

PLANNING WATER SUPPLY: COST-RATE DIFFERENTIALS AND PLUMBING PERMITS,
Cincinnati Univ., OH. Dept. of Economics.
H. C. Goddard, R. G. Stevie, and G. D. Trygg.
Report EPA-600/5-78-008, May, 1978. 202 p, 27 Fig, 21 Tab, 4 Append. R-803596-01.

Descriptors: *Cost analysis, *Water rates, *Forecasting, *Water distribution(Applied), *Water works, *Pricing, Hamilton County(OH), Equity, Economics, Costs, Consumptive use, Water demand, Utilities, Water supply, Regional analysis, Econometrics, Ohio, Planning, *Cincinnati(OH).

Data from the Cincinnati Water Works supply area in Hamilton County, Ohio show that plumbing permit records cannot be used as earlier hypothesized to accurately predict future water use within such customers areas. Also disproven was a supposition that peak-period water users around Cincinnati are subsidized by off-peak users. The study from which these conclusions are derived is concerned with: (1) measurement of costs of water supply; (2) calculation of net revenue differences among customers by class and location; (3) water demand analysis as based on plumbing permit applications. Water supply functions are disaggregated into (1) acquisition and treatment and (2) transmission and distribution. From the breakdown, the cost of delivering water to various customers by class and specific user are calculated as a function of distance, altitude and time of year. Resultant costs are then compared with revenues from each customer class; net revenues from each are calculated and resulting va iations are displayed for further analysis through computer mapping techniques. In general, the pricing structure of the Cincinnati Water Works is equitable for city residents and suburbanites, but correspondence between rates and average delivered costs is weak; moreover, CWW incurs revenue deficits on industrial and commercial water users while obtaining a revenue surplus from residential users. (Harris-Wisconsin)
W80-01315

WASTEWATER MANAGEMENT IN RURAL COMMUNITIES: A SOCIO-ECONOMIC PERSPECTIVE,
For primary bibliographic entry see Field 5D.
W80-01383

CAN OFF-PEAK PUMPING CUT UTILITY POWER COSTS,
Montgomery (James M.), Inc., Pasadena, CA.
For primary bibliographic entry see Field 6D.
W80-01405

POLLUTION CONTROL: ECONOMISTS' VIEWS,
London School of Economics and Political Science (England).
For primary bibliographic entry see Field 6E.
W80-01471

THE ASSESSMENT OF POLLUTION DAMAGE TO AQUATIC RESOURCES: ALTERNATIVES TO THE TRIAL MODEL,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-01549

6D. Water Demand

A SYSTEM FOR REGIONAL ANALYSIS OF WATER AVAILABILITY,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W80-01295

THE DEMAND FOR ANGLING AT THE DERWENT RESERVOIR, 1970 TO 1976,
Newcastle-upon-Tyne Univ. (England).
D. M. Shucksmith.
Journal of Agricultural Economics, Vol 30, No 1, p 25-37, January 1979. 4 Fig, 27 Ref.

Descriptors: *Recreation demand, *Gasoline, *Prices, *Fishing, *Willingness-to-pay, Costs, Recreation facilities, Economics, Elasticity of demand, Rural areas, Tourism, Effects, Fees, Planning, *United Kingdom, Derwent Reservoir(UK), Clawson method.

The Clawson method which links the willingness of visitors to pay travel costs and size of entrance fees, is used to: (1) estimate the demand relationship for angling at the Derwent Reservoir; (2) examine stability of the annual demand schedule 1970-76; and (3) assess effects of changes in real gasoline prices 1970-76 on the demand for fishing at the Derwent Reservoir, and on its general significance for outdoor recreation. Demand for fishing at the Derwent Reservoir should be responsive to changes in real costs of the entire recreation experience, whether in gasoline prices or in entrance fees. However, cross-sectional socioeconomic differences and annual quality variations have little effect. The underlying demand relationship is stable for all seven years. Because demand is highly price-elastic, consumption was drastically reduced as a result of increased costs. Extrapolating this to recreation in general, implies that additional increases in real gasoline prices would have serious effects both for recreation sites and for the outdoor recreation economy. Higher gasoline prices would primarily affect casual day and weekend recreation, leading to shorter trips and a heavier concentration of visitors in the countryside closet to urban areas. (Luedtke-Wisconsin)
W80-01304

PLANNING WATER SUPPLY: COST-RATE DIFFERENTIALS AND PLUMBING PERMITS,
Cincinnati Univ., OH. Dept. of Economics.
For primary bibliographic entry see Field 6C.
W80-01315

PACKAGE PLANTS: ONE SOLUTION TO SMALL COMMUNITY WATER SUPPLY NEEDS,
Culp/Wesner/Culp, El Dorado Hills, CA.
For primary bibliographic entry see Field 5D.
W80-01404

CAN OFF-PEAK PUMPING CUT UTILITY POWER COSTS,
Montgomery (James M.), Inc., Pasadena, CA.
Junn-Ling Chao.
Journal of the American Water Works Association Vol 71, No 5, p 259-263, May 1979. 10 Fig, 4 Ref.

Descriptors: *Reservoir storage, *Storage capacity, *Water storage, *Pumped storage, *Electric power, *Energy cost ratios, *Storage reservoirs, Water costs, Utility costs, Reservoirs, Water supply, Water levels, Water distribution(Applied), Flow.

The author explains and compares four case methods of typical municipal pump/storage operations in an attempt to derive a least cost method of such storage. Many water supply distribution systems that cannot rely on gravity alone rely on a combination of pumping stations and reservoirs. Comparisons are made between strategies of providing water to a community through a system which is continuously pumping new water into storage, a system which pumps only during 10 off-peak hours/day without constant demand, a 10 hour off-peak pumping system with constant demand, and a somewhat more complicated system employing a daily combination of 14 hour peak and 10 hour off-peak pumping. Overall water storage level is found to be highest with the 10 hour off-peak pumping system (pumping rate = 240 percent), and is lowest with the continuous, 24 hour pumping alternative (pumping rate = 170 percent). Conclusions indicate that achieving cost savings through more off-peak pumping must be approached cautiously and on a case-by-case basis because the characteristics of each water distribution system differ and few existing water distribution systems have the reserve pumping, transmission main, and reservior storage capacities needed to pump only at peak

hours. Further, installation of such off-peak pumping capability should be preceded by study of the effects on local power rates, overall system friction loss, and reservoir level vatiation. (Arnold-NC)
W80-01405

WATER SUPPLY CONSTRAINTS ON NIGERIA'S ECONOMIC DEVELOPMENT: THE CASE OF ANAMBRA STATE,
Nigerian Inst. of Social and Economic Research, Ibadan.
D. C. I. Okpala.
I.T.C.C. (International Technical Cooperation Centre) Review, Vol VIII, No 1(29), p 21-35, January 1979, 11 Tab, 33 Ref.

Descriptors: *Water supply, *Water demand, *Water resources development, *Water utilization, *Water requirements, *State government, *Water supply development, Regional development, Economics, Nigeria, Anambra State(Nigeria), Africa, Water projects, Consumptive use, Industrial use(Water), Agriculture, Irrigation, Water costs.

This paper evaluates the current water supply situation in the State of Anambra in Nigeria. Population varies from 60,000 to 320,000 and water supply consumption varies from 8.4 to 18.6 gallons per capita among the major regions of Anambra. Implications for this supply/population picture are that adequate supplies do not now exist in Anambra and thus must be increased for domestic uses, agriculture (irrigation needs), power generation and recreation. An increase in the amount of piped water to provide safe drinking water is essential in fighting the spread of disease in this area. Some areas have almost no water and supplies in many areas are impure. The problem of water inadequacy in Anambra State is partly due to inadequate technological expertise but the main problem is a lack of adequate funds. Good hydrological data exist and water schemes have been planned but no funds are available to execute them. The State government is unable to finance additional water supply services. Funds must be found for provision of adequate water and other infrastructure services, which are prerequisite foundations for real economic development. The funds will have to come from the Federal government in view of the almost complete federalization of the chief revenue sources. (Arnold-NC)
W80-01406

OPTIMAL ALLOCATION OF WATER FOR RURAL AND URBAN USE IN DEVELOPING COUNTRIES WITH SPECIAL REFERENCE TO IRAN,
Aston Univ., Birmingham (England), Management Centre.
For primary bibliographic entry see Field 6A.
W80-01407

WATER RESOURCES DATA OF THE SEWARD AREA, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
L. L. Dearborn, G. S. Anderson, and C. Zenone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-101298, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-11, 1979. 45 p, 6 Fig, 6 Tab, 8 Ref.

Descriptors: *Available water, *Surface waters, *Groundwater resources, *Water quality, Aquifers, Water wells, Water yield, Streamflow, Flow rates, Low flow, Water supply, Flood plains, Flood frequency, Hydrologic data, Hydrographs, Water demand, Projections, Alaska, *Seward area, Log-Pearson distribution, Maritime climate.

Seward, Alaska, obtains a water supply of about 2 million gallons per day primarily from Marathon Springs and the Fort Raymond well field. The springs have supplied up to 800 gallons per minute, and the city's deep wells currently have a combined capacity of about 3,000 gallons per minute. Freshwater is abundant in the area; future public supplies could be derived from both shallow and deep ground water and from stream impoundment with diversion. High deep-aquifer transmissivity at the Fort Raymond well field indicates that additional wells could be developed there. Water quality is generally not a problem for public consumption. A flood potential exists along several streams having broad alluvial fans. (Woodard-USGS)
W80-01427

HYDROLOGIC EFFECTS OF ANNUALLY DIVERTING 131,000 ACRE-FEET OF WATER FROM DILLON RESERVOIR, CENTRAL COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
W. M. Alley, D. P. Bauer, J. E. Veenhuis, and R. Brennan.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A072 555, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-2, January 1979. 17 p, 6 Fig, 4 Tab, 15 Ref.

Descriptors: *Water supply, *Water demand, *Reservoir operation, *Water delivery, Effects, Water quality, Water levels, Elevation, Hydrologic budget, Water storage, Streamflow, Water rights, Surface waters, Synthetic hydrology, Colorado River basin, Evaluation, *Dillon Reservoir(CO), *Hydrologic effects, *Water diversion.

Because of the increased demands for water in eastern Colorado, principally in the urbanizing Denver metropolitan area, increased diversions of water from Dillon Reservoir are planned. Estimates of end-of-month storage in Dillon Reservoir, assuming the reservoir was in place and 131,000 acre-feet of water were diverted from the reservoir each year, were reconstructed by mass balance for the 1931-77 water years. Based on the analysis, the annual maximum end-of-month drawdown below the elevation at full storage would have averaged 54 feet. The maximum end-of-month drawdown below the elevation at full storage would have been 171 feet. The mean-annual discharge-weighted dissolved-solids concentrations in the Colorado River near Glenwood Springs and Cameo, Colo., and Cisco, Utah, for the 1942-77 water years, were computed assuming an annual diversion of 131,000 acre-feet of water from Dillon Reservoir. The average increases in the dissolved-solids concentrations with the 131,000-acre-foot diversion were 15 to 16 milligrams per liter at the three sites. (Woodard-USGS)
W80-01429

PRELIMINARY DATA FOR MADISON LIMESTONE TEST WELL 3, NW1/4 SE1/4 SEC. 35, T. 2 N., R. 27 E., YELLOWSTONE COUNTY, MONTANA,
Geological Survey, Denver, CO. Water Resources Div.; Geological Survey, Huron, SD. Water Resources Div.; Geological Survey, Billings, MT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-01434

GROUND WATER IN THE VICINITY OF CAPULIN, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
D. L. Hart, Jr., and C. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 824, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-79, June 1979. 38 p, 11 Fig, 7 Tab, 20 Ref.

Descriptors: *Groundwater resources, *Groundwater availability, *Water quality, *Potential water supply, *Aquifer characteristics, Hydrology, Water wells, Water yield, Water demand, Projections, New Mexico, *Colfax County(N Mex), *Capulin area(N Mex).

The alluvial deposits within a closed basin near Capulin, New Mexico, are estimated to have 189,000 acre-feet of water in storage. These deposits have an estimated average transmissivity of 400 feet squared per day and represent the major source of ground water. Well yields range from a few gallons per minute to as much as 900 gallons per minute, with average potential yields ranging from about 100 to 200 gallons per minute in areas of greatest saturated thickness. Additional large quantities of water are available for short-term supplies from the saturated basaltic cinders west and northwest of the town of Capulin. Wells completed in the cinders reportedly have produced as much as 2,000 gallons per minute. The chemical quality of water in the alluvium and cinder aquifers appears to be chemically satisfactory for municipal use. The ground water in storage is sufficient to supplement Raton, New Mexico's water needs to the year 2030 at the water demand rate projected by the Bureau of Reclamation. (Woodard-USGS)
W80-01592

6E. Water Law and Institutions

GROUND-WATER STORAGE FOR CALIFORNIA WATER PROJECT,
California State Dept. of Water Resources, Los Angeles. Southern District.
J. J. Coe.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 105, No IR3, Proceedings Paper No 14832, p 305-315, September 1979. 5 Fig, 3 Ref.

Descriptors: *Artificial recharge, *Conjunctive use, *Legal aspects, *Inter-basin transfers, *California, *Inter-agencycooperation, Groundwater basins, Irrigation, Public utilities, Regional analysis, Water law, Water resource development, Management, State water plan.

Environmental opposition and escalated construction costs associated with construction of dams and reservoirs in Northern California have caused the California Department of Water Re soures to examine the feasibility of using groundwater basins in the San Joaquin Valley and Southern California to store State Water Project water during periods of above normal runoff in Southern California for later withdrawal and delivery in subsequent dry years. Conjunctive use of surface and groundwater is not a new concept. However, for many years, there has been a reluctance to initiate conjunctive use because of concerns over legal and institutional aspects such as: (1) What are the priorities between overlying users and public agencies to available storage space and what are the priorities between public agencies; (2) Who owns the water after it's spread or injected and placed in storage; (3) How should state and regional conjunctive use programs be made compatible with local water management operations. In California, two recent State Supreme Court decisions have provided some guidance. (Adams-ISWS)
W80-01282

REGIONAL FACTORS IN THE FORMATION OF THE FISHERMAN'S PROTECTIVE UNION OF NEWFOUNDLAND,
Toronto Univ. (Ontario).
R. J. Brym, and B. Neis.
Canadian Journal of Sociology, Vol 3, No 4, p 391-407, 1978. 4 Fig, 55 Ref.

Descriptors: *Labor unions, *Fish management, *Social aspects, *Political aspects, Regional economies, History, Labor unions, Economics, Fishermen, Social values, History, Fisheries, Canada, *Newfoundland Fishermens union.

Social-stryctyrak factors which produced regional variations in the level of support for the Fisherman's Protective Union (FPU) of Newfoundland (FPU), a populist movement of the 1910s and 1920s, are examined. Focusing on a single determinant of social power, the level of social organization, connections are demonstrated between different patterns of economic underdevelopment, of labor organization and collective political action on one hand, and between the social organization of authority and the suppression of political dissidence on the other. Fisherman apparently were affected by two broad types of organization. Only one, however, characterized by substantial

amounts of capital investment creating a concentrated work force, was conducive to collective political action. A principal opponent for the FPU, the church elite, was sufficiently organized to suppress potential fishermen involvement in the movement in all areas of the island except one. The combination of these two factors explains the relative success and failure of the FPU in cooperatives, abolishing the merchant's right to grade and thereby set the price for fish, regulating the fisheries, and eliminating the credit systems. (Luedtke-Wisconsin)
W80-01307

COMMUNITY INTERDEPENDENCE AND ENVIRONMENTAL QUALITY: PROBLEMS IN MANAGING NON-POINT POLLUTION,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
R. E. Rickson, C. E. Ramsey, and P. J. Nowak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116338, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of Minnesota Report. November 1979. 28 p, 8 Tab, 60 Ref. OWRT A-032-MINN (1).

Descriptors: *Management, *Water quality *Water policy, Decision making, Knowledge, Self-interest.

Implementing environmental goals in a region requires coordination of community efforts. When communities have different interest, coordination is difficult. Residents are likely to respond on the basis of residential self-interest rather than regional 'interests'. Public responses, we argue, are influence by residential self-interest, knowledge and values, and the coordinating roles of local leaders. Two communities in a regional watershed were studied: one town and one rural. Data show that residential self-interest is important to public response, but its impact is limited by public knowledge and values. Leaders are found to occupy key positions; coordinating the flow of information within and between communities, and with outside agencies. (Blake-Minn)
W80-01380

WATER QUALITY MANAGEMENT PLAN: EXECUTIVE SUMMARY.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div of Environmental Management.
For primary bibliographic entry see Field 5D.
W80-01391

WATER QUALITY MANAGEMENT PLAN: IMPLEMENTATION SUMMARY,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div of Environmental Management.
For primary bibliographic entry see Field 5D.
W80-01392

WATER QUALITY AND AGRICULTURE: A MANAGEMENT PLAN,
North Carolina Soil and Water Conservation Commission, Raleigh. Div. of Land Resources.
For primary bibliographic entry see Field 5G.
W80-01393

WATER QUALITY AND WASTEWATER DISCHARGES: A MANAGEMENT PLAN.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div of Environmental Management.
For primary bibliographic entry see Field 5D.
W80-01394

WATER QUALITY AND ON-SITE WASTEWATER DISPOSAL: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5D.
W80-01395

WATER QUALITY AND SOLID WASTE DISPOSAL: A MANAGEMENT PLAN,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5G.
W80-01397

WATER SUPPLY CONSTRAINTS ON NIGERIA'S ECONOMIC DEVELOPMENT: THE CASE OF ANAMBRA STATE,
Nigerian Inst. of Social and Economic Research, Ibadan.
For primary bibliographic entry see Field 6D.
W80-01406

ECONOMIC AND LEGAL ENFORCEMENT MECHANISMS.
Proceedings of a Workshop held in Windsor, Ontario, February 21-22, 1977. International Joint Commission, Report No R-77-1, October 1977. 302 p. Bonner, P. A. (ed).

Descriptors: *Great Lakes, *Point pollution, *Nonpoint pollution, *Water policy, *Pollution abatement, *Regulation, *Economics, *Legal aspects, *Social aspects, *Nominal Group Technique, International Joint Commission, International commissions, Great Lakes region, Water pollution sources, Water pollution control, Non-structural alternatives, Administrative agencies, Canada, Governments, Methodology, Decision making, Jurisdiction, Political aspects, State jurisdiction, Federal jurisdiction.

A synthesized conclusion drawn from presentations given at a workshop on achieving improved water quality in the Great Lakes is that whether 'new' policy mechanisms are used or not, state, provincial, and federal pollution abatement agencies both in the U.S. and Canada should implement more rigorous, specific and effective enforcement measures in their relevant jurisdictions. In the case of point sources, municipal as well as industrial polluters should be given clear economic and legal incentives to reduce their pollution loads. For nonpoint sources and particularly agriculture, voluntary enforcement schemes should be reinforced with mandatory policies and programs which incorporate financial assistance. Fifteen speakers and panelists participated in the 2-day workshop, organized in separate point-source and nonpoint-source segments by the sponsoring Social Sciences, Economics, and Legal Aspects Committee (SSELA) of the Research Advisory Board of the International Joint Commission of Canada and the U.S. on the Great Lakes. The Nominal Group Technique (NGT), a process developed to elicit improved discussion participation in small-group meetings, was tested in workshop sessions. Conclusions: NGT is good for factual discussion/decision situations, for identifying problem/solution elements and for bringing different judgment factors together in one decision area; however, the technique does not work as well when alternative policy decisions must be judged for a single functional consideration. (Harris-Wisconsin)
W80-01467

ECONOMIC IMPACT OF PROPOSED BORON WATER QUALITY STANDARD FOR WOOD RIVER, R76-18,
Southern Illinois Univ. at Carbondale. Dept. of Thermal and Environmental Engineering.
C. B. Muchmore, and W. S. O'Brien.
Illinois Institute for Environmental Quality No 77/19, June 1977. 42 p, 4 Fig, 1 Tab, 26 Ref. 80.088.

Descriptors: *Boron, *Water quality standards, *Economic impact, *Wood River(IL), *Electric powerplants, Illinois, Water quality, Powerplants, Environmental effects, Effluents, Fly ash, Public health, Discharge(Water), Costs, Capital costs, Operating costs, Industries.

The Illinois Power Company, whose ash pond discharge frequently violates boron water quality standards, petitioned the Illinois Pollution Control Board to adopt a proposed change, R76-18, exempting a 0.9 mile section of the Wood River from current 1.0 mg/l boron standards and establishing 25 mg/l standards for that area. If the proposed change is denied, the least cost alternative is construction of a pipeline and pumping facilities to discharge ash pond effluent directly to the Mississippi River 0.9 miles away. Capital cost for the pipeline is estimated at $272,000 with annual operating costs $8,300; total number of annual costs are $33,600, resulting in an additional $0.10 cost to residential customers. Boron concentrations above 0.03-0.04 ppm cause boron toxicity problems in sensitive plants such as citris, violet, and pansy. For semi-tolerant species, boron concentrations of 1.0 to 2.0 ppm are allowed. A 0.3 mg/l boron standard for drinking water has been suggested because of long term adverse human health effects. However, this section of the Wood River flows through a highly industrialized area; its waters are not used for potable water supply, irrigation purposes, fishery, or public recreation. The proposed rule change would have no significant environmental costs or benefits to agriculture, commerce, industry, local government on the people of Illinois. (Danovich-Wisconsin)
W80-01468

THE SOCIAL AND POLITICAL MATRIX OF ENVIRONMENTAL ATTITUDES. AN ANALYSIS OF THE VOTE ON THE CALIFORNIA COASTAL ZONE REGULATION ACT,
Pennsylvania State Univ., University Park. Div. of Man-Environment Relations.
For primary bibliographic entry see Field 6B.
W80-01470

POLLUTION CONTROL: ECONOMISTS' VIEWS,
London School of Economics and Political Science (England).
A. Marin.
The Three Banks Review, No 1212, p 21-41, March 1979.

Descriptors: *Pollution taxes(Charges), *Pollution abatement, *Economic justification, *Regulation, Water pollution control, Taxes, Non-structural alternatives, Monitoring, Control system, Inspection, Law enforcement, Penalties(Legal), Costs.

A study of the social control of individual pollution-causing activities by means of taxes and other charges as contrasted with quantitative pollution limits finds objections to charges as a control instrument, even though that approach is most suitable to the free market system prevalent in most western countries. Advantages of charges: (1) They lead to correct allocation of resources in that the full social costs of undertaking pollution-creating activities are balanced against the benefits. (2) Commercial firms or private individuals considering alternative practices which would lead to different levels of pollution may be induced to abate pollution up to the point where the cost of further abatement just equals the cost of the extra damage. (3) Decision-making in regard to pollution levels is decentralized and therefore easier to administer. (4) Where the central regulating authority is acting with incomplete knowledge in regard to optimal pollution levels, the desired reduction in pollution can be achieved at less cost to the community if charges are levied than if abatement is enforced through regulations. Disadvantages of charges: (1) Communal responsibility as expressed through mandated regulations is a stronger abatement inducement than reliance on individual self-interest. (2) Rather than minimizing costs of producing their output, many firms revise existing production processes and marketing practices when they are forced to do so. (3) A system of charges requires not only that emissions be continuously monitored but that a permanent record (and possibly a cumulative one) of a polluter's emissions be available to the inspectorate. (Harris-Wisconsin)
W80-01471

ENVIRONMENTAL PROTECTION IN COMECON MEMBER NATIONS,
B. Gorizontov, and V. Prokudin.
Problems of Economics, Vol 21, No 8, p 24-40, December 1978. 6 Ref, Translated from Okhrana

okruzhaiuschei sredy v stranakh-chlenakh SEV, Voprosy ekonomiki, No 4 p 68-76, 1978.

Descriptors: *Conservation, *Foreign countries, *Political aspects, *Comprehensive planning, *Environmental control, Pollution abatement, Russia, Poland, Regulation, Governments, Administration, Governmental interrelations, Legislation, Economics, Coordination, Management, Planning, Water policy, Control, Environment, Investment.

Substantial environmental protection results are achieved by cooperative efforts of COMECON member nations of eastern Europe. But at the same time, joint works and proper application of integrated planning programs are needed. This paper reviews environmental protection progress of communist countries. Socialist systems have potential for securing better effective solutions to environmental protection than potential for securing better effective solutions to environmental protection than capitalish approaches because of efficient, comprehensive state regulation on a planned bases. Socialist countries are establishing special state regulatory agencies and legislation is enacted on rational and comprehensive natural resource use. Economic growth and social development planning is closely interconnected with the environment. In 1976 capital investments in nature conservation in the USSR amounted to 1.755 billion rubles. In 1970 capital investment in environmental protection in Polish People's Republic represented 2.9% of total capital investment and 0.6% of national income. In 1974 COMECON member nations and Yugoslavia initiated a General Detailed Program of Cooperation on environmental protection and improvement. Tasks include waste-free technologies; pollution detection methods standardization; high-efficiency gas and water purification equipment; resolution of socioeconomic, educational, and legal problems; and basic exploratory research. (Danovich-Wisconsin)
W80-01472

TRANSFRONTIER POLLUTION IN INTERNATIONAL WATER BASINS,
Eidgenoessisches Amt fuer Umweltschutz, Bern (Switzerland).
A. Droz, and H. Smets.
Report, Organisation for Economic Cooperation and Development, Paris, 1978. 14 p.

Descriptors: *Water pollution control, *Governmental interrelations, *International commissions, International waters, Institutions, Organizations, Water pollution, Governments, Administration, Legal aspects, Planning, Conferences, International Joint Commission, Environmental effects, Professional personnel, Scientific personnel, Projects.

A seminar of the Organization for Economic Cooperation and Development held in Switzerland in June 1977 concluded that during the last 10 years international cooperation has been strengthened for solving transfrontier pollution problems in international water basins. More international commissions have been established, existing commissions were increasingly active and had taken on added responsibilities, and increasingly specific objectives, standards, and measurement programs were being adopted. While commissions vary in powers and aims, all have access to national technical experts for impartial advice. Ecological and economic effects should be included in preparing detailed action proposals to solve environmental problems and competent scientific advice should be obtained before adopting positions. The more data a commission has on its water basin discharges and water quality, the more that rational and effective action programs can be prepared. The U.S. and Canada provide the International Joint Commission (IJC) with all nationally available data. Financial and administrative details and methods of emergency aid for hydrocarbon pollution accidents should be agreed upon prior to any event eliminating action delays at crucial times. Some North American cases considered in discussions included IJC and Great Lakes Agreement Commission. European organizations range from the Saar and Rosselle Commission, to German-Dutch Frontier Commission, to Greek-Bulgarian rivers, to Finnish-Swedish Waters Commission. (Danovich-Wisconsin)
W80-01473

TRANSBOUNDARY GROUND WATER POLLUTION: SURVEY AND TRENDS IN TREATY LAW,
Fordham Univ., Bronx, NY. School of Law.
L. A. Teclaff, and E. Teclaff.
Natural Resources Journal, Vol 19, No 3, p 629-67, July 1979.

Descriptors: *Groundwater, *International law, *Treaties, Groundwater recharge, Groundwater resources, Groundwater availability, Aquifers, Water pollution, Water pollution sources, Water pollution control, United Nations.

Ground water accounts for 70% of the drinking water in member states of the European Economic Community, even more than that in Denmark, the Federal Republic of Germany, and ninety-three percent in Italy. According to the federal Environmental Protection Agency (EPA) half of all drinking water in the United States is from underground sources. Accessible ground water is already endangered and poses a threat to public health in parts of the United States and Europe, especially through pollution by toxic substances, hydrocarbons and nitrates. A detailed analysis is given of the pathways of groundwater contamination and the major sources of ground water pollution (agricultural, industrial, domestic and municipal). International treaties are surveyed which have dealt with ground water as related to surface water and pollution. Also analyzed are the current state of International conventional law, measures already in force or proposed in domestic legislation, and guidelines of international organizations for the harmonization of national laws. Existing treaties and institutions are far from adequate to cope with the serious problems posed by groundwater pollution. (Vloedman-Florida)
W80-01546

FEDERAL ENVIRONMENTAL REVIEW REQUIREMENTS OTHER THAN NEPA: THE EMERGING CHALLENGE,
Cleveland-Marshall Coll. of Law, OH.
R. H. Rosenberg, and A. H. Olson.
Cleveland State Law Review, Vol 27, No 2, p 195-229, 1978.

Descriptors: *Water treatment, *Water pollution, *Standards, *Water quality control, Judicial decisions, Water policy, Recreation, Coasts standards, Water law, Wild River Act.

The effect of specialized environmental review statutes on federal activity is discussed. It is assumed that they will complicate federal environmental review and planning processes because of their tendency to overlap with the National Environmental Policy Act and each other. Five major specialized environmental review statutes which affect the greatest number of federal activities are analyzed: (1) The 1958 Fish and Wilflife Coordination Act; (2) The 1973 Endangered Species Act; (3) The 1966 National Historic Preservation Act; (4) The 1974 Wild and Scenic Rivers Act; and (5) The 1972 Coastal Zone and Management Act. As to these statutes, there is commentary on existing judicial interpretations, identification of emerging trends in the law, and highlighting of problems arising from the proliferation of these types of statutes. (Walker-Florida)
W80-01547

FEDERAL ACQUISITION OF NON-RESERVED WATER RIGHTS AFTER NEW MEXICO,
B. A. Machmeier.
Stanford Law Review, Vol 31, No 5, p 885-911, May 1979.

Descriptors: *Indian reservations, *Water rights, *Federal-State water rights conflicts, Water allocation, State governments, Water law, Constitutional law, Forests.

Evaluated is the recent Supreme Court decision of United States V. New Mexico. That case decided that reserved water was available to the United States only to the extent that it is needed to accomplish the original purpose of the land withdrawal. The Court suggested that when reserved water is unavailable, federal agencies must abide by state water law and acquire water rights as any other public or private appropriator. The role of state law in federal water acquisition envisoned by the Court is unwarranted. Part one discusses the constitutional limits on Congressional power to acquire water. State law cannot limit this power. Private parties affected by the federal use may have a fifth amendment right to compensation. Part two looks at the water acquisition by federal agencies. Congress has the power to delegate its authority to acquire water rights outside of state law to federal agencies. It has specifically delegated this power to the Forest Service. (Walker-Florida)
W80-01548

THE ASSESSMENT OF POLLUTION DAMAGE TO AQUATIC RESOURCES: ALTERNATIVES TO THE TRIAL MODEL,
Environmental Protection Agency, Washington, DC.
R. A. Du Bey, and E. R. Fidell.
Santa Clara Law Review, Vol 19, No 3, p 641-80, Summer 1979.

Descriptors: *Water pollution, *Aquatic environment, *Compensation, *Damages, Federal government, State governments, Water law, Economics, Cost allocation, Cost analysis, Cost comparisons.

One basic weakness in a conservation system based wholly on economic motives is that most members of the land community have no economic value. This statement is equally applicable to aquatic resources, which is basically why no economic value has been fixed for aquatic resources. Consequently, no amount of public compensation funding under current law is guaranteed to go to those in fact injured by water pollution until the valuation problem has been resolved. The existing body of law regarding damage assessment are examined, including the common law approach and several state legislative schemes. The probable consequences of implementing a natural resource assessment scheme based on established natural resource damage assessment procedures and valuation tables are explored. Special attention is paid to the case of Commonwealth of Puerto Rico v. SS Zoe Colocotroni and Senate bill 2083, the 1978 Oil Pollution Liability and Compensation Act, which would establish a strict liability scheme. (Vloedman-Florida)
W80-01549

POLLUTION CONTROL AT THE MARITIME FRONTIER: THE LIMITS OF STATE EXTRA-TERRITORIAL POWER,
P. M. Greenwald.
Santa Clara Law Review, Vol 19, No 3, p 747-75, Summer 1979.

Descriptors: *State jurisdiction, *California, *Water pollution control, *Oceans, Coasts, International waters, Environmental control, Regulation, Legislation, Federal government, Federal jurisdiction, Ships.

Coastal states hold a unique position in the international community. They receive all of the benefits and burdens that sea-borne commerce provides; yet because of our federal system, they lack the power that all coastal nations wield to determine the territorial extent to which they may control that commerce. The extraterritorial applicability of state laws holds great significance especially in the field of environmental protection. California is currently grappling with the problem of controlling such extraterritorial polluters at sea as vessel traffic, drilling platforms, and lightening operations. The California Air Resources Board (ARB) has drafted a set of model rules to be adopted by its regional districts. These rules assert jurisdiction to regulate pollution sources located within 75 miles of shore. In the context of the ARB model rules, the following are examined: (1) the international law of jurisdiction over vessels on the high seas;

the constitutional limitations on state authority beyond territorial waters, and (3) the applicability of state environmental laws to drilling platforms and deepwater ports on the outer continental shelf. (Vloedman-Florida)
W80-01550

GENERAL ADJUDICATION OF WATER RIGHTS,
Ch 139, secs 1 thru 86, 1979 Ariz. Legis. Serv. 405 (West) to be codified in scattered sections of 1, 45 (Ariz. Rev. Stat.).

Descriptors: *Adjudication procedure, *Arizona, *Water rights, Administration, Surface waters, Groundwater, Colorado River, Permits, Legislation, Water law.

In 1979, the 34th legislature of the State of Arizona passed Senate Bill 1239, Waters-Administration of Water Laws; Appeals; Adjudication of Rights. The Act transfers from the State Land Department to the Arizona Water Commission all of the functions, powers contracts, judicial actions and data relating to the administration of surface water and groundwater laws. The general adjudication of water rights is moved from the Land Department and to the Superior Court. Decisions of the commission can be appealed to the Superior Court in the manner set out. Procedures are prescribed for adjudication in the Superior Court. A description is given of certain lands subject to sale in the dry bed of the Colorado River. The process for procurring water rights is also stated. (Walker-Florida)
W80-01551

THE ALLOCATION OF PERCOLATING WATER UNDER THE OKLAHOMA GROUND WATER LAW OF 1972,
Tulsa Univ., OK.
E. B. Jensen.
Tulsa Law Journal, Vol 14, No 3, p 437-76, 1979.

Descriptors: *Oklahoma, *Groundwater resources, *Water allocation(Policy), Prior appropriation, Property values, Water consumption, Water distribution, Water law, Percolating water, Economic efficiency.

The maximum annual yield of fresh ground water for the first ground water basin was determined by final order of the Oklahoma Water Resources Board. This order regulated the administration of ground water under the 1972 Oklahoma Groundwater Law (OGWL). The OGWL does not respond to the practical need of concentrating the privilege of water use in few enough hands. The amount which each of the privileged users is entitled to use is inadequate to obtain economic benefits. The problem with the OGWL is that it elevates property interests to such a high level that the practical value in the more arid regions is minimal. This conclusion is reached by tracing the history of Oklahoma water law and the distinction between property interests in water and regulation of water use. The effect of this distinction is present in the 1949 OGWL which is discussed and compared to the 1972 law. Also discussed are the protection of prior rights by the OGWL, a determination of maximum annual yield, and the changes in allocation based on new data. (Walker-Florida)
W80-01552

WATER MANAGEMENT OF THE FUTURE: A GROUNDWATER STORAGE PROGRAM FOR THE CALIFORNIA STATE WATER PROJECT,
California State Dept. of Water Resources, Sacramento.
R. B. Robie, and P. R. Donovan.
Pacific Law Journal, Vol 11, No 1, p 41-64, October 1979.

Descriptors: *Conjuctive use, *Water, *California, *Water management(Applied), Groundwater, Environmental effects, Storage, Cost comparisons, Water storage, Institutional constraints, Legislation.

Water supplies of the California State Water Project should be considered for a conjunctive use program. In this respect the underground storage of surface water supplies is advocated. The program's relative efficiency as to cost effectiveness and environmental impact is discussed. A theoretical model is provided to help identify the institutional, operational, and environmental factors that must be considered before a ground water storage program can be introduced. The proposed legislation of the California Governor's Commission is analyzed in light of major legal issues surrounding water storage priorities. A working ground water demonstration project is provided to show how a ground water storage program used in conjunction with surface water can work successfully. (Walker-Florida)
W80-01553

BEYOND SECTION 858: A PROPOSAL GROUND-WATER LIABILITY AND MANAGEMENT SYSTEM FOR THE EASTERN UNITED STATES,
National Energy Law and Policy Inst., OK.
J. S. Lowe, L. C. Ruedisili, and B. N. Graham.
Ecology Law Quarterly, Vol 8, No 1, p 131-61, 1979.

Descriptors: *Water allocation(Policy), *Water management(Applied), *Groundwater availability, Groundwater, Withdrawal, Beneficial use, Reasonable use, Water consumption, Water demand, Water rights.

The adoption of section 858 from the second Restatement of Torts is evaluated. The section addresses liability for withdrawal of ground water which results in the interference of another's beneficial land use. The value of the Restatement view is that it alters the American rule which offers and overlying landowner user a secure, almost absolute right, while providing tenuous protection to his neighbors. The American rule equates reasonable use with beneficial use of one's land. The Restatement view also embraces the concept of reasonableness, but it offers the overlying user more limited protection from liability. Problems of application and logic still remain. Section 858 assumes an abundance of water, but will be applied to disputes resulting from water shortages. There is substantial reliability on certainty which is unfair to individuals functioning within the economic system. The public interest in ground water resources is not protected. A system is proposed which tailors the western states' approach to meet eastern state conditions. Three possible systems are suggested which all attempt to permit development of the resources concommitant with protecting the resource. (Walker-Florida)
W80-01554

UNILATERAL ACTION VERSUS UNIVERSAL EVOLUTION OF SAFETY AND ENVIRONMENTAL PROTECTION STANDARDS IN MARITIME SHIPPING OF HAZARDOUS CARGOES,
D. A. Fitch.
Harvard International Law Journal, Vol 20, No 1, p 127-74, Winter 1979.

Descriptors: *Water quality standards, *International law, *Water pollution control, Hazards, Water law, Risks, Ships, Organizations, Standards, Safety.

The legal systems and measures, both international and national, through which nations have attempted to reduce the risks associated with oceanic shipping of hazardous cargoes is examined. The efforts of international organizations to develop generally acceptable international standards for maritime safety are deemed inadequate by the United States (US). The U.S. has unilaterally adopted stricter standards and enforcement measures. The relative merits of unilateral and universal standards for maritime pollution prevention and maritime safety are discussed. The elements involved in the choice between these two modes of action are evaluated. Adoption of similarly stricter national standards by other states would indicate that the U.S. standards represent a level of caution which is generally accepted internationally. Before this regression away from cooperative development of international law occurs, the competent international organization should adapt itself to respond more effectively to the needs of coastal and port states. (Walker-Florida)
W80-01555

OIL AND GAS OPERATION IN THE ATLANTIC OUTER CONTINENTAL SHELF: AN OVERVIEW OF THE REGULATORY AND LITIGATION-RELATED CONSTRAINTS TO DEVELOPMENT,
Le Boeuf, Lamb, Leiby and Mac Rae, Washington, DC.
G. C. Best.
Connecticut Law Review, Vol 11, No 3, p 459-81, Spring 1979.

Descriptors: *Continental shelf, *Oil industry, *Federal-State water rights conflicts, Federal jurisdiction, State governments, Gasoline, Coasts, Judicial decisions, Submerged Lands Act, Legislation, Energy.

The regulatory and litigation-related constraints which inhibit the leasing and development of oil and gas in the Atlantic outer continental shelf (OCS) are described. The regional resistance to OCS leasing in the Atlantic is reviewed. The interplay between state and federal jurisdiction over OCS activities is discussed. Principal federal laws affecting offshore oil and gas operations include: (1) the 1953 Outer Continental Shelf Lands Act (OSCLA); (2) the Submerged Lands Act; (3) the Coastal Zone Management Act; and (4) the Coastal Land Impact Program. Recent litigation challenging the actions of federal regulatory authorities in the context of OCS and coastal zone administration is examined. These include suits brought by Suffolk County and Massachusetts to prevent the Interior Department from proceeding with the Baltimore Canyon and Georges Bank lease sales, and those brought by oil companies to injoin the National Oceanic and Atmospheric Administration's approval of the California and Massachusetts Coastal Zone Management Programs. Certain features of the OCSLA amendments and the increase in the number of interests groups indicate that litigation will increase in this area. (Vloedman-Florida)
W80-01556

CLEAN WATER ACT, RSOURCE CONSERVATION AND RECOVERY ACT AND CONTROLS ON WETLANDS AND THE COASTAL ZONE,
J. Quarles.
Federal Regulation of New Industrial Plants, Monograph No 28, p 22-51, Environment Reporter, Vol 10, No 1, May 4, 1979.

Descriptors: *Water pollution control, *Water quality standards, *Water treatment, Permits, Solid wastes, Wastes, Wetlands, Standards, Dredging, Navigable waters, Coasts.

The Clean Water Act prohibits any discharge into public waters without a permit. Stringent pollution control requirements are placed on all discharges. New source performance standards (NSPS) apply to plants beginning construction after the standards have been promulgated. Environmental impact statements (EIS) are required before the federal Environmental Protection Agency issues a permit to a plant subject to NSPS. Applicaton procedures for permits, modifications and discharges into municipal systems are explained. The Resource Conservation and Recovery Act (RCRA) imposes certain requirements on all solid waste disposal, but focuses primarily on hazardous waste. A permit program was created covering facilities for hazardous waste disposal and a system from generation to disposal. Under the wetlands and coastal zone controls, Corps of Engineers permit is required for any dredge and fill project in navigable waters. An EIS may be required also. There is a strong national policy against filling of wetlands. The 1972 Coastal Zone Management Act provides federal funds for state programs and requires a federal permit applicant to comply with state requirements. (Quarles-Florida)

W80-01557

ELECTRICAL POWER COMMITTEE (ANNUAL REPORT): PART II B, CLEAN WATER ACT (CWA) DEVELOPMENTS,
American Bar Association, Washington, DC. Natural Resources Law Section.
Natural Resources Lawyer, Vol 12, No 1, p 19-33, 1979.

Descriptors: *Water quality control, *Nuclear power plants, *Water pollution standards, Judicial decisions, Permits, Planning, Pollutants, Standards, Regulation, Effluents.

There have been numerous recent judicial decisions dealing with the Clean Water Act (CWA). The federal Environmental Protection Agency (EPA) has continued its development of thermal effluent limitations guidelines in response to a federal court decision. Development regulation settling ocean discharge criteria are also proceedings. The EPA has continued its review of best available technology requirements and effluent limitations guidelines for toxic substances for the steam-electric category pursuant to a settlement agreement. Secion 311 of the CWA relating to hazardous substances regulations was amended after a federal court set aside previous EPA regulations. The EPA is required by one case to develop water quality criteria for sixty-five toxic pollutants. EPA began wholesale reorganization and reform of the National Pollutant Discharge Elimination System procedural rules. This reform and changes in the program due to judicial decisions are reviewed. The Nuclear Regulatory Commission has been active recently in interpretation of its role in evaluating aquatic environmental impacts when licensing nuclear power plants. The considerable enforcement litigation under the CWA in 1978 is reviewed. (Quarles-Florida)
W80-01558

COASTAL LAND PRESERVATION: OBSTACLES TO EFFECTIVE STATE ACTION,
D. Pool.
Columbia Journal of Environmental Law, Vol 4, No 2, p 254-73, Spring 1978.

Descriptors: *Coasts, *Shore protection, *State governments, Legislation, Regulation, Environmental control, Zoning, Public lands, Public access, Shores, Wetlands.

In recent years, population pressures, changing recreation patterns and industrial growth have intensified demand for shorefront areas. Concurrently, the need to protect coastal plants and wildlife and the supporting terrain has become increasingly apparent. States, which continue to retain primary responsibility for shorelines, have enacted legislation to meet the threat to coastal ecology. In some cases, this has involved heavy reliance on local zoning or a virtually categorical prohibition of development in specified coastal areas. In other states, legislatures have adopted sophisticated and comprehensive programs of coastal development, which balance preservation with controlled development. Substantial legal challenges have mounted against legislation of both types. The solution offered here incorporates features of traditional zoning law and the public trust doctrine. Zoning can provide a helpful framework for sustaining the substantive purposes of coastal area regulation. The public trust doctrine deals specifically with the state and public interest in coastal areas, offering an historically valid method of protecting them. (Vloedman-Florida)
W80-01559

MARINE RESOURCES COMMITTEE (ANNUAL REPORT),
American Bar Association, Washington, DC. Natural Resouces Law Section.
Natural Resources Lawyer, Vol 12, No 1, p 127-31, 1979.

Descriptors: *Continental shelf, *Oil pollution, *Resources development, Oil spills, Resources, Federal Government, Oceans, Legislation, Judicial decisions, Leases.

In 1978 Congress amended the 1953 Outer Continental Shelf Lands Act. These amendments and judicial activity relating to the Act are reviewed. Provisions added to the Act include: (1) Specific guidelines with respect to the promulgation of regulations concerning operations on the Outer Continental Shelf (OCS); (2) Several newly specificed bidding schemes; (3) Provisions regarding lease terms; and (4) Detailed requirements for exploration plans. The Act now requires the inclusion of specific subjects in the Secretary's Annual Report concerning learning and production on the OCS. In addition to the above amendments, 13 new sections were added to the Act which include: (1) OCS leasing program which will be coordinated with affected states and local governments; (2) Procedures for citizen enforcement of the act through litigation; (3) Procedures concerning oil and gas development; and (4) A grant to the federal government of the right to obtain its royalty in the purchase and disposition of oil and gas. Oil spills procedures and a fisherman's contingency fund were also established. (Quarles-Florida)
W80-01560

NATIONAL OCEAN POLLUTION RESEARCH AND DEVELOPMENT AND MONITORING ACT OF 1978-LEGISLATIVE HISTORY.
H.R. Rep. No 626, 95th Cong., 2nd Sess. (1978) reprinted in 5 U.S. Code Cong. and Ad. News 1258 (1978).

Descriptors: *Oceans, *Oil pollution, *Research and development, *Sewage sludge, Legislation, Legal aspects, Administrative agencies, Administrative costs, Seashores, Sewage disposals.

This House Report, 95-626-Part One, on the 1978 National Ocean Pollution Research and Development and Monitoring Planning Act contains: (1) The Bill's Purpose; (2) Committee Action; (3) The Background and Need for the Legislation; (4) An Explanation of the Bill; (5) Committee Views; (6) Cost and Budget Data; (7) Oversight Findings and Recommendations; and (8) The Congressional Budget Office Cost Estimate. The Act has two main purposes. The first is to establish a comprehensive five-year federal plan for environmental research and development related to marine pollution, with particular emphasis on the inputs, fates and effects of petroleum, sewage sledge, and other pollutants in the marine environment. The second is to designate the National Oceanic and Atmospheric Administration as the lead federal agency for marine pollution environmental research and development. The 1967 Torrey Canyon oil spill ignited an ever increasing awareness of the potential hazards of accidental and willfull discharges of pollutants into the marine environment. The failing of current federal marine environment research is the lack of efforts in determining the long-term fates and effects of various pollutants. (MacGregor-Florida)
W80-01561

SPILLING OIL MAY BE HAZARDOUS TO YOUR WEALTH,
R. L. Puglisi.
Natural Resources Journal, Vol 19, No 3, p 735-52, July 1979.

Descriptors: *Federal Water Pollution Control Act, *Oil pollution, *Oil spills, Water pollution, Water quality control, Oceans, Water pollution services, Water pollution control, Water quality regulation.

Section 1321 of the Federal Water Pollution Control Act Amendments gives the Federal government comprehensive power regarding the discharge of oil and other hazardous substances. Section 1321 provides for penalties and clean-up expenses, and promotes a co-operative federal attitude to encourage state participation in oil discharge clean-up and prevention. The article focuses on subsections (b), (c), (f), (i) and (o) of Section 1321 which seems to be the most important in providing a systematic framework for penalty imposition. The Section defers to the President to determine 'harmful quantities'. The Administration has determined that discharges of oil which cause a film of sheen upon or discoloration of the surface water are harmful. The section provides for a Nation Contingency Plan to effectuate clean-up of spills which pose a threat to the general welfare. The federal government is responsible for initial clean-up but may recover such costs and actual expense from the party deemed liable. More prosecutions under the section are foreseen due to greater quantities of oil and its products being transported annually. (Corey-Florida)
W80-01562

OPTIONS FOR CONTROLLING NON-POINT SOURCE WATER POLLUTION: A LEGAL PERSPECTIVE,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.
D. L. Uchtmann, and W. D. Seitz.
Natural Resources Journal, Vol 19, No 3, p 587-609, July 1979.

Descriptors: *Sedimentation, *Soil conservation, *Nitrogen, *Water pollution control, Leaching(Nitrogen), Erosion, Federal Water Pollution Control Act, Agricultural runoff, Constitutional law, Legal aspects.

A legal analysis is given of various alternative approaches for controlling agricultural non-point pollution sources for compliance with Section 208 of the 1972 Federal Water Pollution Control Act Amendments. The control policies discussed represent a reasonable range of alternatives, including programs that relay on general education and voluntary and mandatory participation of farm operators. The control of most plan nutrients is discussed in the context of erosion and sedimentation control programs with nitrogen control receiving special attention. Voluntary sedimentation control programs include educational, cost-sharing and tax incentive policies that would be implemented on a state-federal cooperative level. Mandatory sedimentation control programs must be carefully considered in light of Fifth Amendment taking, reasonable regulation and public purpose doctrines since row crop restrictions are an enormous burden on farmers. Nitrogen Control Programs could be enacted on a state level to protect the general welfare and water quality. A per-acre nitrogen restriction is advocated if it is established that nitrogen in water is a significant health hazard. The final mix of the alternatives put forth to control agricultural nonpoint sources of pollution will probably be determined by legislative and administrative procedures. (Corey-Florida)
W80-01563

GEOTHERMAL RESOURCES,
Ch 87, Secs 1 thru 17, 1979 Ariz. Legis. Serv. 354 (West) (to be codified in scattered sections of 27, 37, 42 and 43 Ariz. Rev. Stat.).

Descriptors: *Geothermal resources, *Arizona, *Water resources development, Water resources, Legal aspects, Geothermal studies, Groundwater, Legislation, Leases, Energy.

The Arizona legislature has adopted legislation to provide for the development of geothermal resources. The act exempts geothermal resources and development from the states' water laws, except where such resources are comingled with surface water or groundwater or where there is an impairment of the groundwater supply. In order to foster geothermal development the act authorizes the state land department to lease land and promulgate rules and regulations governing geothermal development. The law specifies the department procedures for receiving and reviewing lease applications. It also requires leases to contain certain provisions, such as, a royalty payment by lessee of not less than 12 1/2 percent of the gross value of the resources, and a minimum of 10 year term. Other provisions of the law deal with surface use by the lessee, assignment of leases, and surrender of lands held under lease. (Mac Gregor-Florida)
W80-01564

GROUNDWATER TRANSFERS,
Ch. 29 Secs, 1 thru 11, 1977 Ariz. Legis. Serv. 103

(West) (to be codified in scattered sections of 45 Ariz. Rev. Stat.).

Descriptors: *Arizona, *Groundwater availability, *Groundwater resources, Groundwater movement, Transfer, Comprehensive planning, Management, Water rights, Legislation.

The Arizona Legislature determined that a strict application of existing law preventing groundwater transfer would jeapordize the economy and well-being of its people. It was also found that the rapid depletion of groundwater resources necessitated a long-range comprehensive plan for groundwater management. Senate Bill 1391 (Groundwater-Transfers) was passed. The Act provides: (1) the procedure for transferring groundwater from and within critical groundwater areas; (2) for certain rights, liabilities, and remedies relative to groundwater; (3) for disposition of municipal treatment plant water; and (4) for a moratorium on designating new critical groundwater areas. (Walker-Florida)
W80-01565

OCEANS REPORT,
A. D. Wiener.
Lawyer of the Americas, Vol 11, No 1, p 195-204, Spring 1979.

Descriptors: *Oceans, *Continental shelf, *Resource development, Fishing, Antarctic, Transportation, Governmental interrelations, Pollution, Mining, Federal Government, Legislation.

Recent governmental activity is examined in these areas: (1) government reorganization; (2) marine pollution; (3) fishing; (4) antarctic resources; (5) marine transportation; and (6) deep sea mining. A Department of Commerce study, entitled 'US Oceans Policy in the 1970's; State's and Issues,' listed three major ocean policy issues as: (1) the need for a nations ocean policy framework to be used for longterm management of coastal and ocean resources; (2) the extent to which the United States will exercise jurisdiction over ocean and seabed resources; and (3) the need for national policy in developing ocean and coastal resources. The 1978 Outer Continental Shelf Lands Act Amendments streamline the procedures required for obtaining private leases to exploit mineral resources on the outer continental shelf and also mandate Interior Department supervision of oil and gas drilling activities to insure that air quality standards are not violated. In 1978, the U.S. signed agreements to set maritime boundaries with Mexico, Venezuela and Cuba. The U.S. and Canada agreed to a fisheries treaty for the east coast but will refer disagreements over boundary-setting in the Gulf of Maine to a third party for binding arbitration. (Vloedman-Florida)
W80-01566

THE CONTROL OF TOXIC POLLUTANTS UNDER THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972,
Iowa Univ., Iowa City.
K. L. Hall.
Iowa Law Review, Vol 63, No 3, p 609-47, February 1978.

Descriptors: *Toxins, *Federal Water Pollution Control Act, *Water quality standards, Water pollution sources, Water Quality Act, Water quality control, Federal Government, Industrial wastes, Effluents.

In enacting the 1972 Federal Water Pollution Control Act Amendments, Congress intended to create a comprehensive scheme to restore and maintain the chemical, physical and biological integrity of the nation's waters. Included in the scheme were controls on the discharge of toxic water pollutants. The control on the discharge of toxic water pollutants to date has not been as effective as Congress intended. As a result of the settlement of law suits initiated by the Natural Resources Defense Council and other environmental groups, EPA has now set a new course for the effective regulation of toxic water pollutants. The consent decree in that settlement signed by environmental groups, EPA, and one industry intervenor mandated that EPA promulgate limitations to control sixty-five toxic pollutants for twenty one key industrial groups. The limitations are to be achieved by July 1, 1983. The settlement agreement and the provision of the Clean Water Act, mark the beginning of a program, which, if aggressively implemented and enforced, will result in the control of toxic water pollution and the return of clean, healthful water. (Vloedman-Florida)
W80-01567

THE FRESHWATER WETLANDS ACT: PERMISSIVE REGULATION VS. CONSTRUCTIVE TAKING,
E. J. Rizzo.
Albany Law Review, Vol 43, No 2, p 295-321, Winter 1979.

Descriptors: *New York, *Freshwater wetlands, *Eminent domain, Administrative agencies, Judicial decisions, Wetlands, Legal aspects, Land use, Land management, Land development.

The New York legislature has enacted a law to protect the state's freshwater wetlands. The law is carried out through an extensive system of land use regulations and a permit program administered by the state's Department of Environmental Conservation. The net result is the virtual prohibition of all development on wetlands within the act's jurisdiction, unless the Department issues a permit. A question is raised as to whether the act constitutes a taking of property without just compensation. The Act's provisions are examined. Court decisions on the taking issue from around the country are reviewed. A recent New York case which found the act effected a taking is also considered. The act is necessary and contains safeguards which ensure its constitutionality. (MacGregor-Florida)
W80-01568

FEDERALISM IN THE COASTAL ZONE: THREE MODELS OF STATE JURISDICTION AND CONTROL,
North Carolina Univ. at Chapel Hills.
T. J. Schoenbaum, and F. Parker, Jr.
North Carolina Law Review, Vol 57, No 2, p 231-60, February, 1979.

Descriptors: *Coastal zone, *Governmental interrelations, *Land management, *State jurisdiction, Administrative agencies, State governments, Coastal plains, Legal aspects, Federal Water Pollution Control Act, Federal government, Land use.

The federal government has recently asserted considerable jurisdiction over coastal zones. However, federalism does still exist in coastal management. The federal legislation has opened new opportunities, although it requires states to exercise or ease their responsibilities. The ways states may control their own coastal zones is analyzed. A state may work through a grant of power under federal law by, for example, adapting water quality standards under the Federal Water Pollution Control Act (FWPCA). Under the Coastal Zone Management Act, states can control federal activities in the coastal zone because the law requires federal agencies to act consistently with approved state management programs. Other examples are given of opportunities for state control. Within the framework of federal law, the states will play the dominant role in determining the future of the coastal zone. (MacGregor-Florida)
W80-01569

FLOOD CONTROL-RELOCATION,
Ch 217, secs 1 thru 15, 1979 Ariz. Legis. Serv. 967 (West) (to be codified in scattered sections of 26, 37, and 45 Ariz. Rev. Stats.).

Descriptors: *Arizona, *Flood control, *Relocation, Floods, Loans, Flood protection, Flood plains, Legislation, Land classification.

In 1979, the Arizona legislature passed House Bill 2457, Flood Control-Relocation; Land exchange. The Act provides for; (1) a flood relocation and state land exchange program, (2) a floodplain land exchange fund; (3) powers of the Arizona Water Commission; (4) the perfection and enforcement of lines for remedial measure employed by the state engineer relative to dams; (5) powers of county and special flood control districts; (6) raising of the levy limitation for special flood control districts; (7) items which qualify as compensable costs under the state flood control assistance program; (8) amounts of limitations on and eligibility for alternative flood control assistance; (9) flood control bans to certain flood control districts; (10) terms and conditions of such loans; (11) flood control loan fund; and (12) a restriction on use of certain monies appropriated to the alternative flood control assistance fund. (Walker-Florida)
W80-01570

NATIONAL OCEAN POLLUTION RESEARCH AND DEVELOPMENT AND MONITORING PLANNING ACT OF 1978,
Act of May 8, 1978. Pub. L. No 95-213, 92 Stat. 228, 5 U.S. Code Cong. and Ad. News (1978) (codified at 33 U.S.C. 17o1 et. seq.).

Descriptors: *Oceans, *Water pollution, *Research and development, Legislation, Oil pollution, Legal aspects, Administrative agencies, Administrative costs, Seashores, Sewage sludge, Sewage disposal.

The 1978 National Ocean Pollution Research and Development and Monitoring Planning Act creates a comprehensive 5-year plan for federal oceanic activities; it provides for information gathering; and it designates the National Oceanic and Atmospheric Administration as the agency in charge. The 5-year plan must; (1) identify national needs and problems which relates to specific aspects of ocean pollution; (2) establish the priority in which those needs should be met and the problems solved; and (3) contain a detailed explanation of any revisions made. The Act also provides financial assistance for research in ocean pollution, and directs the agency administraton to establish an ocean pollution research program. (Mac Gregor-Florida)
W80-01571

AN ANALYSIS OF SECTION 208 OF THE FWPCA AMENDMENTS OF 1972 AND A SUGGESTED MODEL SURFACE WATER RUNOFF ORDINANCE,
R. Bush.
Available from Eastern Water Law Center, University of Florida, Gainesville, 32611. 131 p, 2 App, $5.24. (1978).

Descriptors: *Florida, *Federal Water Pollution Control Act, *Surface runoff, Water management, Drainage districts, Drainage practices, Water treatment, Water quality control, Water quality standards, Water pollution control.

Proper land use regulation and enlightened water quality management can substantially avoid the adverse environmental impacts associated with surface water runoff. This Model Surface Water Runoff Control Ordinance demonstrates a realistic implementation of a harmonious relationship between continued development and the natural environment. This ordinance is suggested for the Melbourne-Tillman Drainage District in Brevard County, Florida to alleviate the water problems while meeting the Section 208 requirements of the 1972 Federal Water Pollution Control Act. Section 208 ties together many of the Acts provisions water control planning provisions and greatly affects the treatment and management of surface water runoff. Section 208 planning is done on an areawide basis. Funding is provided for a two-year planning process which must address the problems of both point and non-point source water pollution. Implementaion of the plan may be the responsibility of existing or newly created local, regional of state agencies. The Act has many enforcement procedures if violation of a permit, a standard or limitation occurs. (Corey-Florida)
W80-01572

WHAT POSSIBILITIES EXIST FOR LOCAL LEGISLATION TO ASSIST IN CONTROLLING

LAND USE DEVELOPMENT (SPECIAL TREATMENT DISTRICT),
J. Mulligan.
Available from Eastern Water Law Center, University of Florida, Gainesville, 32611. 65 p, 3 App, $2.60. (1978).

Descriptors: *Land development, *Florida, *Land use, Land classification, Ecology, Eminent domain, Environmental control, Local governments, Zoning, Regulation.

Special Treatment (ST) areas are designated where an areas essential ecology cannot be adequately protected under conventional zoning regulations. This land use control device is in effect in Collier County, Florida and could prevent potentially harmful development from taking place in other environmentally endangered areas. To enact such legislation local government must have the power to regulate land use such as Florida's Municipal Home Rules Power Act. The regulations must have sufficient permit standards and must avoid the most serious problem of not effectrating a taking of private property. ST areas are chosen upon consideration of elevation, soil, structure, vegetation and natural conditions. The key element of the ST program of Collier county is Transferable Development Rights. This allows landowners to conform to the necessary new regulations or to transfer them 'residential density credit' to another property. This concept separates the right to develop land from the ownership of the land itself. Many conditions and regulations attach to such a land use program. The major attraction lies in offsetting the economic hardship to the landowners as a result of a resource protective program. (Corey-Florida)
W80-01573

WATER-SUPPLY CONSIDERATIONS RE PALM BAY, FLORIDA,
A. Draves.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611. 70 p, $2.80. (1978).

Descriptors: *Florida, *Water managemant(Applied), *Water resources, *Water supply development, Drainage districts, Shallow aquifers, Artesian wells, Water demand, Water resources development, Water policy, Water supply.

General Development Corporation is developing Palm Bay, a large residential community in Brevard County, Florida. Palm Bay is plagued with water problems including quality, supply, exploitation, and state and local regulation. Any withdrawal or use program must be limited to such uses or withdrawal capable of perpetual support. This reasonable use approach is mandatory in Palm Bay where some supply sources have been diminished in capacity to the point of permanent damange. The primary cause of the endangered water supply is the overdrainage of the Melbourne-Tillman Drainage District. The Florida legislature mandates utmost cooperation between municipalities, counties, water management districts and the Department of Environmental Regulation in seeking to utilize all practical means of supplying water from surface and ground sources. Regional water supply authorities have been given water management authority to levy taxes, exercise eminent domain and other powers to alleviate the water problems. Florida case law could support a permit system for water use as legislatively intended. This could have drastic effects on common-law, riparian reasonable use doctrines. Suggested approaches of obtaining additional water in Palm Bay include injection of freshwater into the Florida aquifer and impoundment of excess waters. (Corey-Florida)
W80-01574

A DWINDLING WATER SUPPLY AND THE INDIAN STRUGGLE TO RETAIN ABORIGINAL AND WINTERS DOCTRINE WATER RIGHTS.
United Effort Trust, Inc., Washington, DC.
American Indian Journal, Vol 4, No 12, p 35-44, December 1978.

Descriptors: *Water supply development, *Indian reservations, *Water allocation(Policy), Water rights, Water supply, Indians, Legislation, Judicial decisions, Federal government, Economic impact, Economic justification.

In order to develop their lands the American Indians need water. There is an adequate body of law, if properly administered, to protect Indian water rights, and thus allow for development. The Winter's doctrine is one example. In the Winters Case the United States Supreme Court held the Indians had by their treaties, retained rights to their reservation's water. Under Western water law of prior appropriation the Court's recognition of Indian water claims meant the Indians water rights took priority over all others. As a reaction against Winters and other such law, legislation is being proposed to deprive the Indians of their rights. Included is a reprint of a commentary on such a piece of legislation. Water policy proposals by President Carter and the Comptroller General are also analyzed. (MacGregor-Florida)
W80-01576

THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM IN ILLINOIS: THE STATE ASSUMES DIRECT AUTHORITY,
Environmental Protection Agency, Chicago, IL. Enforcement Div.
G. C. Ginsberg, and R. M. Harsch.
De Paul Law Review, Vol 27, No 3, p 739-60, Spring 1978.

Descriptors: *Illinois, *Waste water treatment, *Federal Water Pollution Control Act, Federal Government, Legislation, Permits, Pollutants, Water pollution control, State governments, Water quality standards.

Congressional intent that the states should assume primary responsibility for controlling water pollution within their boundaries is expressed several times in the Clean Water Act, and evidenced by the National Pollutant Discharge Elimination System (NPDES) permit program. The EPA transferred NPDES authority to Illinois in October 1977. Discussed are NPDES permit program, Illinois' permit program prior to adoption of NPDES, and how Illinois overcame the obstacles which inhibited assumption of NPDES authority for five years. Although several problems have resulted in a slowdown in permit processing and enforcement, Illinois has the necessary regulatory mechanisms to satisfactorily administer the state's water pollution control program. (Vloedman-Florida)
W80-01577

UNITED STATES INTERESTS AND THE LAW OF THE SEA,
E. L. Richardson.
Lawyer of the Americas, Vol 10, No 3, p 651-57, Winter 1978.

Descriptors: *United Nations, *Law of the sea, *International waters, United States, Oceans, Continental shelf, Marine geology, Commercial fishing, Foreign trade, Mining, Resources development.

In 1973, the Third United Nations Conference on the Law of the Sea (LOS) began the task of developing a comprehensive legal regime to govern the worlds oceans. The United States (US) has been guided in its negotations by seven major U.S. concerns: (1) global order; (2) mineral resources of the deep sea bed; (3) nonliving resources of the continental shelf, (4) living resources; (5) marine sicentific research; (6) protection of the marine environment; and (7) commerce and national security. To achieve stability, predictability, and order in world affairs, the U.S. has advocated the inclusion in the LOS treaty of a system of compulsory and binding dispute settlement. Since about 60% of the world's oil and gas reserves are in the continental margin and since the U.S. has a broad continental margin, we have a significant interest in determining the extent of each nation's coastal jurisdiction. The negotiating text before the Conference adequately represents the U.S. major concerns except for the development of deep seabed mineral resources. The seabed mining test must be improved before the U.S. can approve the treaty. (Vloedman-Florida)
W80-01578

ACCOMMODATION OF INDIAN TREATY RIGHTS IN AN INTERNATIONAL FISHERY: AN INTERNATIONAL PROBLEM BEGGING FOR AN INTERNATIONAL SOLUTION.
K. E. Petty.
Washington Law Review, Vol 54, No 2, p 403-58, March 1979.

Descriptors: *Pacific Northwest U.S., *Canada, *United States, *Indian reservation, Fish conservation, Fish management, Fish migration, Salmon, Fisheries, International Commission, International Law, Treaties.

The anadromous fish resources of the Pacific Northwest have been threatened for decades by an oversized fleet and by regulatory complexities and uncertainties. The United States now faces a dilemma which results from having treaties with two different signatories, Canada and native Northwest Indians. The Steven treaties guaranteed Washington Indian tribes 50% of the harvestable fish returning to their traditional hunting grounds. These fishing rights were reaffirmed in a 1974 U.S. District Court decision in United States v. Washington. The United States has also entered into a treaty with Canada providing for joint management of the fishing through the International Pacific Salmon Fisheries Commission. The commission was formed to achieve the purpose of protection, preservation and extension of the sockeye and pink salmon fisheries in the Fraser River System. The future cooperation between the United States and Canada has been threatened by their differing policies with respect to their native Indians. This is critical since the international nature of the salmon migration makes management dependent on American and Canadian cooperation. If Indian treaty rights are implimented too hastily, the result may be Canadian alienation. (Vloedman-Florida)
W80-01579

THE PROMISE OF DEEP SEA MINING,
National Oceanic and Atmospheric Administration, Washington, DC.
R. A. Frank.
Mining Congress Journal, Vol 64, No 2, p 73-74, 121-22, February, 1978.

Descriptors: *Mining, *Beds under water, *International waters, *Resource development, Natural resources, Legal aspects, Environmental effects, Federal government, Oceans, Research and development, Foreign countries, United Nations.

Deep seabed mineral development is entering a critical period where substantial progress can occur. The Law of the Sea Conference (LCS) and both the executive and legislative branches of the United States government have been assessing possible actions. Uncertainties are the reason for caution. Environmentalists are conerned about the impact of the retrieval and processing of the ore-rich nodules. These uncertainties are not a basis for not proceeding, but are a warning that technological development and exploitation must proceeed concomitantly with environmental analysis. The LCS negotiations are tied indelibly to deep sea mining. In view of the disappointing result in the deep seabed negotiations of conference sessions, President Carter has decided there is no reason to delay domestic seabed mining legislation. There is additional concern that the LCS Treaty could impede research and hinder ocean development. It is feared the seabed authority established in the present text of the LCS Treaty will lead to fewer benefits for developed and devloping countris. (Ewing-Florida)
W80-01580

6F. Nonstructural Alternatives

AN ASSESSMENT OF SOME ECONOMIC EFFECTS OF FIA LAND USE REQUIREMENTS

ON URBAN COASTAL ZONE DEVELOPMENT,
Mississippi State Univ., Mississippi State. Div of Business Research.
L. R. Cheatham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116262, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University Report, October 1979. 61 p, 2 Fig, 15 Tab, 16 Ref. OWRT A-127-MISS (1), 14-34-0001-9026.

Descriptors: *Economic impact, *Floodplain insurance, *Floodplain zoning, *Land use, *Coastal structures, *Urban sociology, Economic impact, Evaluation, Flood control, Construction costs, Community development, Land development, Property values, Employment, *Urban coastal floodplains, *Mississippi Gulf Coast, *Biloxi(MS), *Floodplain ordinances, *FIA land use criteria, National Flood Insurance Program, Land values, Property taxes.

Land use requirements for eligibility in the National Flood Insurance Program have not caused any significant decreases in total annual construction in urban coastal floodplains along the Mississippi Coast. Construction activity in Zone A has continued at high levels. Relativey high cost of elevating residential structures, along with other factors unrelated to ordinances, have caused some relocation of new construction to other areas of communities. Inability to construct commercial structures to comply with ordinances and maintain functional utility has prevented some commercial construction. Construction employment impacts have been negligible. Values of land and existing structures have increased in communities, but increases have been less in Zone A. Total county construction employment and income have not been affected by ordinances. In the typical community of Biloxi, less than half of total new construction in Zone A is actually regulated due to exemptions for repairing, remodeling, etc., not exceeding 50% of structure value. In this community, construction of regulated new structures decreased slightly, but patterns in non-residential new structures did not confirm any decrease. Total construction in Biloxi has increased since ordinances were implemented.
W80-01381

THE SOCIAL AND POLITICAL MATRIX OF ENVIRONMENTAL ATTITUDES. AN ANALYSIS OF THE VOTE ON THE CALIFORNIA COASTAL ZONE REGULATION ACT,
Pennsylvania State Univ., University Park. Div. of Man-Environment Relations.
For primary bibliographic entry see Field 6B.
W80-01470

THE FRESHWATER WETLANDS ACT: PERMISSIVE REGULATION VS. CONSTRUCTIVE TAKING,
For primary bibliographic entry see Field 6E.
W80-01568

6G. Ecologic Impact Of Water Development

MANAGEMENT ASPECTS OF FISHPOND DRAINAGE,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
S. Hejny.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 399-403, 1978. 4 Fig.

Descriptors: *Marsh management, *Fish management, *Drainage effects, *Ponds, Wetlands, Freshwater marshes, Marsh plants, Marshes, Wildlife Muskrats, Farm ponds, Wildlife management, Water levels, Drainage practices.

Summer drainage of fishponds reduces the sedimentation of both antochthonous and allochthonous organogenous materials, and favors the aeration of the entire fishpond bottom soil complex. Rapid mineralization of the whole complex of organic matter induced by summer drainage slows down the penetration of helophytes into the open water. Summer drainage is important for exploited or cultivated reed-belts as it brings about a retreat of the muskrat populations for several years. Winter drainage is used to control certain aquatic and littoral macrophytes by frost damage to their rhizomes situated near the bottom surface. (See also W80-01209) (Steiner-Mass)
W80-01246

ECOLOGICAL EFFECTS OF FISHPOND AMELIORATION,
Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.
S. Hejny, and S. Husak.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 409-415, 1978. 1 Fig.

Descriptors: *Marsh management, *Marsh plants, Wetlands, Freshwater marshes, Vegetation regrowth, Wildlife, Fish management, Farm ponds, Littoral, *Ecological effects.

In modern pond management, amelioration is mainly performed in two ways: (1) the mechanical way, using heavy machinery and (2) the biotechnical way, employing duck- and goose-farming. The heavy machinery technique employs scrapers for removal of the littoral vegetation during winter or summer drainage of a fishpond. This practice results in a change in the character and physiognomy of the fishpond and changes in the bottom soils, mineral nutrients, and hydrological regimes. It frequently creates favorable conditions for the regeneration of macrophyte communities characteristic of meso- to oligotrophic habitats. Ducks and geese ameliorate ponds by feeding on plants and by suppressing the development of certain plant communities by their accumulated excrements. (See also W80-01209) (Steiner-Mass)
W80-01248

BIBLIOGRAPHY OF ENVIRONMENTAL STUDIES ON LAKE CHAMPLAIN,
For primary bibliographic entry see Field 2H.
W80-01581

7. RESOURCES DATA

7B. Data Acquisition

SELECTION OF SAMPLING AREAS IN ASSESSMENT OF PRODUCTION,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. P. Ondok, and J. Kvet.
In: Pond Littoral Ecosystems, Springer-Verlag, New York, p 163-174, 1978. 3 Fig, 3 Tab.

Descriptors: *Marsh plants, *Productivity, *Sampling, *Measurement, Wetlands, Freshwater marshes, Ponds, Littoral, Standing crop, Biomass, Census, Assay, Estimating, Non-destructive tests, Roots.

Macrophyte production and biomass estimates were made in nearly monospecific stands which frequently occur in the littorals of South Bohemia and South Moravian fishponds. In a monospecific stand, the selection of sampling plots and methods depends on the aim of the investigation. Three different techniques were applied: (1) The biomass was measured in plots with the highest density, selected intentionally within a stand. This technique provides an estimate of the maximum production capacity. (2) The average biomass present in the whole area occupied was estimated by various methods. (3) The seasonal changes in shoot biomass were followed both by direct and indirect methods which provided the basis for growth analysis. All three techniques yielded data on the aerial biomass. The underground biomass was assessed only in some instances. (See also W80-01209) (Steiner-Mass)
W80-01223

A STATISTICAL TECHNIQUE FOR DETERMINING RAINFALL OVER LAND EMPLOYING NIMBUS 6 ESMR MEASUREMENTS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
E. Rodgers, H. Siddalingaiah, A. T. C. Chang, and T. Wilheit.
Journal of Applied Meteorology, Vol 18, No 8, p 978-991, August 1979. 10 Fig, 12 Tab, 32 Ref.

Descriptors: *Rainfall, *Remote sensing, *Satellites(Artificial), *Southeast U.S., Temperature, Microwaves, Data collections, Sampling, Data processing, Statistical methods, Statistical models, Mathematical models, Statistics, Analytical techniques, Meteorology. Nimbus 6, ESMR measurements.

At 37 GHz, the frequency at which the Nimbus 6 Electrically Scanning Microwave Radiometer (ESMR 6) measures upwelling radiance, it has been shown theoretically that the atmospheric scattering and the relative independence on electromagnetic polarization of the radiances emerging from hydrometeors make it possible to monitor remotely active rainfall over land. In order to verify experimentally these theoretical findings and to develop an algorithm to monitor rainfall over land, the digitized ESMR 6 measurements were examined statistically. Horizontally and vertically polarized brightness temperature pairs from ESMR 6 were sampled for areas of rainfall over land as determined from the rain recording stations and the WSR 57 radar and for areas of wet and dry ground (whose thermodynamic temperatures w ere greater than 5 C) over the southeastern United States. These three categories of brightness temperatures were found to be significantly different in the sense that the chances that the mean vectors of any two populations coincided were less than 1 in 100. Since these categories were significantly different, classification algorithms were then developed. Three decision rules were examined: the Fisher linear classifier, the Bayesian quadratic classifier, and a non-parametric linear classifier. The Bayesian algorithm was found to perform best, particularly at a higher confidence level. An independent test case analysis showed that a rainfall area delineated by the Bayesian classifier coincided well with the synoptic-scale rainfall area mapped by ground recording rain data and radar echoes. (Sims-ISWS)
W80-01262

MEASURING HYDRAULIC CONDUCTIVITY IN CLAY SOILS: METHODS, TECHNIQUES, AND ERRORS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia).
D. S. McIntyre, R. B. Cunningham, V. Vatanakul, and G. A. Stewart.
Soil Science, Vol 128, No 3, p 171-183, September 1979. 3 Fig, 8 Tab, 18 Ref.

Descriptors: *Hydraulic conductivity, *Soils, *Clays, *Measurement, *Analytical techniques, Soil properties, Permeameters, Irrigation, Clay loam, Instrumentation, Hydraulic gradient, Pores, Gases, Expansive clays, Soil water movement, Cores, Methods, Swelling soils.

A standard method for determining hydraulic conductivity of packed, fragmented material has been evaluated for clay soils, 15 in all, covering a range of water stability and degree of swelling. The particular method tested is a comparative, or analogue-type, measurement, widely used in irrigation capability studies. The data were presented, along with related soil properties, with the results for three nonclay soils for comparison. The value of divided outflow permeameters for measurement in both soil cores and fragmented material was also investigated; theoretically this method allows correction for wall flow, or for the effects of deformation near the wall when the soil swells. Equivalent hydraulic conductivity values were obtained with constant-head and falling-head techniques, except very early in an experiment. Replacement of air with carbon dioxide in the packed soils, before application of water, reduced variability and made experimentation more tractable. The effect of covering the surface of the soil with sand, a variation

sometimes used to alleviate slaking and dispersion, depended strongly on the nature of the soil and was not recommended. Examination of instrument and measuring errors showed that these could be large, but statistical analysis of the date indicated a relatively low between-sample variability of the measured hydraulic conductivity and other properties of the packed soil. (Visocky-ISWS)
W80-01265

A CLOSE-INTERVAL WATER SAMPLER WITH MINIMAL DISTURBANCE PROPERTIES,
Oslo Univ. (Norway).
I. A. Blakar.
Limnology and Oceanography, Vol 24, No 5, p 983-988, September 1979. 5 Fig, 11 Ref.

Descriptors: *Water sampling, *Equipment, *Data collections, On-site data collections, Water chemistry, Bioassay, Plankton, Sampling, Surveys, Lakes, Limnology, Water samplers.

A simple, pneumatically operated, multilevel sampler, easily constructed of cheap, readily available material, was described. Syringes of different volumes can be attached swiftly and can be interchanged at appropriate intervals. External parts are immovable during filling, thus reducing disruption of microstratifications and keeping contamination of samples to an absolute minimum. The sampler can be used for dissolved gas analyses and multiple bioassay investigations. (Sims-ISWS)
W80-01269

A DEVICE TO HOLD AND IDENTIFY ROCK-FILLED BASKETS FOR BENTHIC SAMPLING IN LARGE RIVERS,
Battelle Pacific Northwest Labs., Richland, WA. Ecosystems Dept.
T. L. Page, and D. A. Neitzel.
Limnology and Oceanography, Vol 24, No 5, p 988-990, September 1979. 3 Fig, 5 Ref.

Descriptors: *Sampling, *Benthos, *Rivers, Equipment, Data collections, On-site investigations, On-site data collections, Rocks, Sediments, Benthic fauna, Benthic flora, Rock-filled baskets.

A holder with rock-filled baskets attached at intervals in specific, easily identifiable locations provides a means of benthic sampling under adverse conditions of current and visibility. Two methods of bagging the rock-filled baskets were described. (Sims-ISWS)
W80-01270

A DURABLE, RESUABLE ENCLOSURE SYSTEM THAT COMPENSATES FOR CHANGING WATER LEVELS,
Indiana Univ. at Bloomington. Dept. of Biology.
D. H. Landers.
Limnology and Oceanography, Vol 24, No 5, p 991-994, September 1979. 2 Fig, 5 Ref.

Descriptors: *Lakes, *On-site investigations, *Equipment, Design, Materials, Water levels, Winds, On-site tests, Testing, Limnology, Enclosure systems.

Low-cost enclosures (2-m diameter) made of UV-resistant, cross-laminated polyolefin sheeting reinforced with a grid of twisted polyester filaments have a depth-compensating capacity from 0.5 to 2.2 m and can be used where water level may fluctuate. Field testing for 126 days showed six such enclosures to be convenient and durable. (Sims-ISWS)
W80-01271

EFFECT OF SURFACE ROUGHNESS ON THE MICROWAVE EMISSION FROM SOILS,
Computer Sciences Corp., Silver Spring, MD.
B. J. Choudhury, T. J. Schmugge, A. Chang, and R. W. Newton.
Journal of Geophysical Research, Vol 84, No C9, p 5699-5706, September 20, 1979. 7 Fig, 3 Tab, 22 Ref.

Descriptors: *Remote sensing, *Microwaves, *Soil moisture, Theoretical analysis, Mathematical models, Model studies, Measurement, On-site investigations, Soil temperature, Soil water, Soils, Soil science, Microwave emission, Roughness effects.

The effect of surface roughness on the brightness temperature of a moist terrain was studied through the modification of Fresnel reflection coefficient and using the radiative transfer equation. The modification involved introduction of a single parameter to characterize the roughness. It was shown that this parameter depends on both the surface height variance and the horizontal scale of the roughness. Model calculations were in good quantitative agreement with the observed dependence of the brightness temperature on the moisture content in the surface layer. Data from truck mounted and airborne radiometers were presented for comparison. The results indicated that the roughness effects are great for wet soils where the difference between smooth and rough surfaces can be as great as 50K. (Sims-ISWS)
W80-01277

THE RESULTS OF TEN YEARS' EXPERIMENTAL STUDY ON PLYNLIMON, MID-WALES, AND THEIR IMPORTANCE FOR THE WATER INDUSTRY,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2A.
W80-01290

7C. Evaluation, Processing and Publication

A SYSTEM FOR REGIONAL ANALYSIS OF WATER AVAILABILITY,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2A.
W80-01295

GROUND-WATER AVAILABILITY IN TEXAS, ESTIMATES AND PROJECTIONS THROUGH 2030,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W80-01297

OCCURRENCE, AVAILABILITY, AND CHEMICAL QUALITY OF GROUND WATER IN THE EDWARDS PLATEAU REGION OF TEXAS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W80-01298

RECORDS OF WELLS, CHEMICAL ANALYSES, AND WATER LEVELS OF SELECTED EDWARDS WELLS, BEXAR COUNTY, TEXAS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W80-01299

GEOLOGICAL SURVEY RESEARCH 1977,
Geological Survey, Reston, VA. Water Resources Div.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $6.00.

Descriptors: *Natural resources, *Programs, *Projects, *Water resources, *Geologic investigations, United States, Foreign countries, Mineralogy, Water analysis, Analytical techniques, Land use, Mapping, Data collections, Chemical analysis, Geothermal studies, Oil, Coals, Remote sensing, Satellites(Artificial), Evaluation, *U.S. Geological Survey projects, Cooperating agencies.

This U.S. Geological Survey activities report includes a summary of 1977 fiscal year scientific and economic results accompanied by a list of geologic and hydrologic investigations in progress and a report on the status of topographic mapping. The summary of results includes: (1) Mineral and water resources, (2) Engineering geology and hydrology, (3) Regional geology, (4) Principles and processes, (5) Laboratory and field methods, (6) Topographic surveys and mapping, (7) Management of resources on public lands, (8) Land information and analysis, and (9) Investigations in other countries. Also included are lists of cooperating agencies and Geological Survey offices. (Woodard-USGS)
W80-01416

PROGRAMS AND ACTIVITIES OF THE MISSOURI DISTRICT, WATER RESOURCES DIVISION, U.S. GEOLOGICAL SURVEY, FISCAL YEAR 1979,
Geological Survey, Rolla, MD. Water Resources Div.
W. M. Kratzer.
Geological Survey open-file report 79-1058, July 1979. 57 p, 2 Fig, 4 Tab, 125 Ref.

Descriptors: *Water resources, *Projects, *Programs, *Water quality, *Missouri, Publications, Bibliographies, Data collections, Sites, Hydrologic data, Networks, Gaging stations, Crest-stage gages, Low-flow, Urban runoff, Reviews.

Water-resources investigations of the U.S. Geological Survey in Missouri consist of collecting hydrologic data and conducting interpretive investigations. The data and the results of the investigations are published or released by either the U.S. Geological Survey or by cooperating agencies. This report describes the data-collection activities and investigations in Missouri for the 1979 fiscal year and provides an extensive list of water-resources references for the State. (Woodard-USGS)
W80-01417

WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR 1978--VOLUME 1. ATLANTIC SLOPE BASINS, HUDSON RIVER TO CAPE MAY,
Geological Survey, Trenton. NJ. Water Resources Div.
Geological Survey Water-Data Report NJ-78-1, June 1979. 558 p, 14 Fig, 5 Tab, 36 Ref.

Descriptors: *New Jersey, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Atlantic Slope basins(NJ).

Water resources data for the 1978 water year for New Jersey consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume includes the Atlantic Slope basin, Hudson River to Cape may, and contains discharge records for 72 gaging stations; tide summaries for 7 stations; stage and contents for 15 lakes and reservoirs; water quality for 39 gaging stations, 154 partial-record stations, and 185 wells; and water levels for 18 observation wells. Also included are 45 crest-stage partial-record stations and 38 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by U.S. Geological Survey and cooperating State and Federal agencies in New Jersey. (Woodard-USGS)
W80-01430

WATER RESOURCES DATA FOR NEVADA, WATER YEAR 1978,
Geological Survey, Carson City, NV. Water Resources Div.
Geological Survey Water-Data Report NV-78-1, June 1979. 368 p, 9 Fig.

Descriptors: *Nevada, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Nevada consist of records of discharge and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 126 gaging stations; stage and contents for 20 lakes and reservoirs; water-quality data for continuing-record stations at 30 stream sites and for partial-record stations at 69 stream sites, 2 lake sites, and 7 wells; and water levels for 185 observation wells. Also included are 109 crest-stage partial-record stations and 13 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Nevada. (Woodard-USGS)
W80-01431

MAP SHOWING PRINCIPAL DRAINAGE BASINS, PRINCIPAL RUNOFF-PRODUCING AREAS, AND SELECTED STREAMFLOW DATA IN THE KAIPAROWITS COAL-BASIN AREA, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
D. Price.
Available from Branch of Distribution, USGS, Box 25286, Fed. Ctr. Denver CO 80225, price $1.25. Geological Survey Miscellaneous Investigation Series Map I-1022-E, 1978. 1 Sheet, 3 Ref.

Descriptors: *Streamflow, *Runoff, *Precipitation(Atmospheric), *Watersheds(Basins), *Mapping, Perennial streams, Ephemeral streams, Intermittent streams, Snowmelt, Rainfall, Drainage area, Discharge(Water), Flow rates, Utah, *Kaiparowits coal-basin area.

This is one of several maps in the U.S. Geological Survey Miscellaneous Investigations Map Series that describe the geology and related natural resources of the Kaiparowits coal-basin area, Utah. About 96 percent of the area drains to the Colorado River, mostly through the Escalante River and Wahweap, Warm, and Last Chance Creeks. The remaining 4 percent drains to the Great Basin through the Sievier River. The Escalante River and several of its headwater tributaries are perennial streams, but most others in the area are intermittent of ephemeral. Estimated average annual runoff in the area ranges from less than 1 inch in most places to more than 10 inches in the headwater area of the Escalante River. Most of the runoff, which occurs during late spring and early summer, results from melting snow and seasonal rains. Summer cloudburst flooding is common throughout the area. Peak flood flows of more than 3,000 cubic feet per secnod have been recorded from drainage areas of less than 100 square miles, and a peak floodflow of more than 15,000 cubic feet per second has been recorded on the Paria River. (Woodard-USGS)
W80-01438

LAND COVER MAP OF THE GREEN SWAMP AREA, CENTRAL FLORIDA,
Geological Survey, Austin, TX. Water Resources Div.
B. F. McPherson.
Available from Branch of Distribution, USGS, 1200 S. Eads St. Arlington, VA. 22202, price $1.50. Geological Survey Miscellaneous Investigations Series Map I-1134, 1979. 1 Sheet, 3 Fig, 3 Ref.

Descriptors: *Florida, *Marshes, *Swamps, *Land use, Vegetation, Trees, Forests, Range grasses, Citrus fruits, Pastures, Land reclamation, Surface waters, Soil-water-plant relationships, Ecosystems, Mapping, Biological communities, *Green Swamp, *Central Florida, *Land cover map.

The Green Swamp area occupies about 870 square miles of swampy flatlands and sandy ridges in central Florida. Five major drainage systems originate within or near the swamp and flow in several directions to the sea. The land cover and vegetation of the Green Swamp area has been broken into 15 categories: (1) cypress forest, (2) river bottom swamp, (3) mesic hammock forest, (4) mixed swamp forest, (5) pine flatwoods, (6) sandhill uplands, (7) liveoak stands, (8) marshes and wet prairies, (9) rangeland, (10) pasture, (11) upland pasture, (12) citrus groves, (13) stripped land, (14) built-up land, and (15) water bodies. Each category has a color code and is mapped at a scale of 1:63,350 (1 inch to the mile). (Woodard-USGS)
W80-01439

GEOLOGICAL SURVEY RESEARCH 1978,
Geological Survey, Reston, VA. Water Resources Div.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $6.50. Geological Survey Professional Paper 1100, 1978. 464 p, 4 Fig, 4 Tab, 537 Ref.

Descriptors: *Natural resources, *Programs, *Projects, *Water resources, *Geologic investigations, United States, Foreign countries, Mineralogy, Water analysis, Analytical techniques, Land use, Mapping, Data collections, Chemical analysis, Geothermal studies, Oil, Coals, Remote sensing, Satellites(Artificial), Evaluation, U.S. Geological Survey projects, Cooperating agencies.

This U.S. Geological Survey activities report includes a summary of 1978 fiscal year scientific and economic results accompanied by a list of geologic and hydrologic investigations in progress and a report on the status of topographic mapping. The summary of results includes: (1) Mineral and water resources, (2) Engineering geology and hydrology, (3) Regional geology, (4) Principles and processes, (5) Laboratory and field methods, (6) Topographic surveys and mapping, (7) Management of resources on public lands, (8) Land information and analysis, and (9) Investigations in other countries. Also included are lists of cooperating agencies and Geological Survey offices. (Woodard-USGS)
W80-01587

NOTES ON SEDIMENTATION ACTIVITIES, CALENDAR YEAR 1977,
Geological Survey, Reston, VA. Water Resources Div.
Geological Survey Office of Water Data Coordination report, April 1979. 442 p, 1 Fig, 2 Tab, Append.

Descriptors: *Sedimentation, *Projects, *Programs, *Publications, *Reviews, Sediment transport, Particle size, Sediment control, Sediment discharge, Sediment distribution, Sediment load, Sediment sorting, Sediment yield, Sedimentation rates, United States, Alaska, Hawaii, Puerto Rico.

This report is a digest of information furnished by Federal agencies conducting sedimentation investigations on work in progress or planned, important findings, new methods, new publications, laboratory and other research activities, and other pertinent information. The material has been organized by major drainage regions in the conterminous United States, Alaska, Hawaii, Puerto Rico, and foreign activities. There is also a section on research and other activities. (Woodard-USGS)
W80-01593

WATER RESOURCES OF THE SWINOMISH INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
B. W. Drost.
Geological Survey Water-Resources Investigations 79-12 (open-file report), 1979. 83 p, 20 Fig, 5 Plates, 10 Tab, 16 Ref.

Descriptors: *Water resources, *Evaluation, *Indian reservations, *Water quality, *Hydrologic budget, Washington, Surface waters, Groundwater resources, Available water, Water resources development, Potential water supply, Well data, Water levels, Chemical analysis, Saline water-freshwater interfaces, *Swinomish Indian Reservation(Wash).

Average total inflow to and outflow from the hydrologic system of the Swinomish Indian Reservation, Wash., is 24 cfs (cubic feet per second). Recharge to the ground-water reservoir is 8 cfs. The study area is underlain by three types of unconsolidated deposits: the uppermost unit is till, the intermediate unit is sand and gravel, and the lowermost unit is clay and silt. During 1975 the average rate of water use was 0.19 cfs. About 70 percent was pumped from the ground-water reservoir and the rest was imported. Dissolved-solids concentrations are 10-20 mg/L (milligrams per liter). In the zone of saltwater, differsion concentrations up to 1,570 mg/L were measured. Human interaction with the hydrologic system has had little effect on water quality. Ground-water quality is generally well within acceptable limits for most uses. If 20 percent of ground-water can be intercepted then a net rate of withdrawal of 1.6 cfs can be attained. Aquiculture development is possible on the two largest streams in the reservation in the form of incubation stations handling 600,000 eggs each. (Woodard-USGS)
W80-01599

8. ENGINEERING WORKS

8A. Structures

LARGE-SCALE FREEZING WORK FOR SUBWAY CONSTRUCTION IN JAPAN,
Tokyo Metropolitan Government (Japan).
M. Miyoshi, T. Tsukamoto, and S. Kiriyama.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 397-415, April 1979. 10 Fig, 5 Tab.

Descriptors: *Tunneling, *Frozen soils, *Underground structures, *On-site investigations, Tunnel construction, Freezing, Frozen ground, Foreign countries, Foreign research, Temperature, Measurement, Construction, Equipment, *Japan.

In this freezing work, 4 parallel tunnels are being constructed simultaneously by the freezing method under a river in the central part of Tokyo. Over the proposed tunnels there exists an old concrete arch bridge across the river. In addition, in the river there are piers of an expressway viaduct quite close to the tunnels to be constructed. Under such conditions, this freezing work is being carried on with great care, taking safety measures as described below. (1) Prevention of excessive growth of frozen zone: installation of heating pipes; and partial application of steel pipe wall for earth retaining instead of ground freezing. (2) Minimization of damage caused by expansion of frozen soil: rationalization of freezing procedure to prevent confined freezing; extraction of surplus groundwater by vacuum pumps; and use of stabilizing liquid to reduce frost expansion pressure. (3) Strict watch for frozen soil: installation of instruments for measuring soil temperatures and displacements; and constant observation by a centralized control/watch system. (See also W80-01498) (Humphreys-ISWS)
W80-01526

THE SOIL-FREEZING METHOD FOR LARGE TUNNEL CONSTRUCTIONS,
Holzmann (Phillip) A. G., Frankfurt am Main (Germany, F.R.).
H. Wind.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 417-423, April 1979. 4 Fig.

Descriptors: *Tunneling, *Frozen soils, *Underground structures, Frozen ground, Tunnel construction, Freezing, Construction, Foreign countries, Methodology, *Switzerland, *Finland, *Germany.

A new and important impetus to further development of the soil-freezing method has come from tunnelling works executed in Stuttgart, Aarburg, Helsinki, Frankfurt, Dusseldorf, and Zurich. These examples of the use of the soil-freezing method

applied in large tunnelling projects showed that this construction method can compete well with traditional methods in both technical and economic aspects. This has been made possible by the efforts of participant engineers of various disciplines of the executing firms, by scientists and by understanding clients. It is a motivation for all concerned to continue their cooperation in order to find solutions for the many problems still unsolved in this field. (See also W80-01498) (Humphreys-ISWS)
W80-01527

SUBWAY CONSTRUCTION IN STUTTGART UNDER PROTECTION OF A FROZEN SOIL ROOF,
Holzmann (Phillip) A. G. , Frankfurt am Main (Germany, F. R.).
G-P. Jonuscheit.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 425-428, April 1979.

Descriptors: *Tunneling, *Frozen soils, *Underground structures, Frozen ground, Tunnel construction, Tunnel linings, Freezing, Construction, Marl, Gypsum, Excavation, Methodology, Foreign countries, Gunite, *Germany.

Experiences gained on the building of the City Railway turning loop, Stuttgart, Secion 12, were described, where the new Austrian tunneling method was used in connection with the freezing technique. The Metro-tunnel lies in leached-out gypsum marl and unleached zones, respectively. In a section of this tunnel within the leached-out gypsum marl, the excavation was protected by a frozen soil roof in order to keep away any water seepage which could be dangerous for the evcavation itself and for the buildings superimposed as well. The drilling for freeze pipes, the installation and operation of the freezing system, and the tunnel driving included the erection of the final support were described. A point of special interest was the application of the shot-crete method as the shotcrete has to adhere to the frozen soil and has to harden sufficiently before the hardening process is interrupted by frost penetration. (See also W80-01498) (Humphreys-ISWS)
W80-01528

GROUND FREEZING FOR SUPPORT OF OPEN EXCAVATIONS,
Terrafreeze Corp., Lorton, VA.
For primary bibliographic entry see Field 2G.
W80-01529

8B. Hydraulics

OPEN CHANNEL FLOW WITH VARYING BED ROUGHNESS,
Birmingham Univ. (England).
For primary bibliographic entry see Field 2E.
W80-01280

COST OF CONTROLS FOR 'SMALL HYDROELECTRIC PLANTS' OR RIVER SYSTEMS,
Oregon State Univ., Corvallis. Dept. of Electrical and Computer Engineering.
For primary bibliographic entry see Field 6A.
W80-01388

8D. Soil Mechanics

GROUND FREEZING,
For primary bibliographic entry see Field 2C.
W80-01498

FROST HEAVE OF UNSATURATED LOAMY SOIL UNDER FIELD CONDITIONS,
Leningrad Inst. of Constructional Engineers (USSR).
For primary bibliographic entry see Field 2C.
W80-01501

INTERRELATIONSHIP OF THE PRINCIPAL PHYSIOCOMECHANICAL AND THERMOPHYSICAL PROPERTIES OF COARSE-GRAINED FROZEN SOILS,
Kuybyshevskii Inzhenero-Stroitelnyi Inst. (USSR).
Frozen Soil Science and Power Plant Construction Branch Research Lab.
For primary bibliographic entry see Field 2C.
W80-01510

ICE LENS STRUCTURES, COMPRESSION STRENGTHS AND CREEP BEHAVIOR OF SOME SYNTHETIC FROZEN SILTY SOILS,
Continental Oil Co., Ponca City, OK.
For primary bibliographic entry see Field 2C.
W80-01511

CREEP BEHAVIOUR OF FROZEN SOILS IN UNIAXIAL COMPRESSION TESTS,
Karlsruhe Univ. (Germany, F.R.). Inst. of Soil Mechanics and Rock Mechanics.
H. Eckardt.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 185-195, April 1979. 9 Fig, 6 Ref.

Descriptors: *Frozen soils, *Compression strength, *Creep, *Soil strength, Laboratory tests, Strain, Stress, Frozen ground, Loads(Forces), Mechanical properties, Temperature, Analytical techniques, Soil science, Cryogenics.

The stress-strain behavior of frozen soils is often described by means of creep curves from uniaxial or triaxial creep tests. Ten or twelve tests of similar samples are required to obtain a good relationship between stress, strain, temperature, time, or strain rate. To reduce the required number of samples, it is possible to apply the compression load in creep tests stepwise. Therefore, creep curves for different stress levels can be obtained from one sample. In this paper the bearing capacity of cylindrical samples of frozen medium sand under constant uniaxial compression stress and under stepwise increased stresses was compared. It was shown how to use these different creep curves to describe the stress-strain behavior of frozen soils. (See also W80-01498) (Sims-ISWS)
W80-01512

CREEP CHARACTERISTICS OF FROZEN SOILS,
Shimizu Construction Co., Ltd., Tokyo (Japan).
K. Takegawa, A. Nakazawa, K. Ryokai, and S. Akagawa.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 197-205, April 1979. 10 Fig, 3 Tab, 3 Ref.

Descriptors: *Frozen soils, *Creep, *Soil strength, Laboratory tests, Compression strength, Mechanical properties, Frozen ground, Freezing, Theoretical analysis, Temperature, Moisture content, Soils, Soil types, Elastic deformation, Analytical techniques, Soil science, Cryogenics.

Consideration of the creep characteristics of frozen soil is required when it is used for the construction of retaining walls. It is generally accepted that there are three kinds of frozen soils, i.e., frozen soil without ice lenses, frozen soil with layers of ice lenses, and frozen soil with needle-like ice lenses, influenced by freezing conditions and physical properties of the soil itself. This paper was a study of properties of deformation and rheological and strength characteristics of frozen soil with an unconfined compression creep test and an unconfined compression test. The test results showed that existence of alternate ice layers in the frozen soil affects properties of deformation rather than those of strength. Generally, elastic strain appears instantaneously upon loading, and deformation increases with the lapse of time, finally leveling off to a certain value as long as the load is below a limited value. Stress at the time of the greatest of the leveling-off strains is called an upper yield value sigma sub u. It was found that when a stress applied to frozen soil without ice lenses is below the upper yield value mentioned above: (1) strain is linear to time lapse expressed in logarithms; and (2) strain is linear to the stress applied. (See also W80-01498) (Sims-ISWS)
W80-01513

EFFECT OF SPECIMEN SHAPE ON CREEP RESPONSE OF A FROZEN SAND,
Ecole Polytechnique de Montreal (Quebec). Centre d'Ingenierie Nordique.
B. Ladanyi, and J. Arteau.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 207-222, April 1979. 7 Fig, 1 Tab, 25 Ref.

Descriptors: *Frozen soils, *Creep, *Compression strength, *Laboratory tests, Analytical techniques, Frozen ground, Freezing, Sands, Temperature, Strain, Stress, Mechanical properties, Soil strength, Soil science, Cryogenics.

The stress-strain and strength behavior of frozen soils is most often studied in a conventional uniaxial or triaxial compression test. However, available experimental evidence shows that the results obtained in such tests may be considerably affected by the test conditions, i.e., by the specimen shape and the method of axial load transfer to the specimen ends, both of which affect the uniformity of stress and strain distribution in the sample. The methods proposed for solving the problem of load transfer to the specimen ends differ considerably for brittle and ductile materials, respectively. Since a frozen soil may behave either as a brittle or as a ductile material, depending on strain rate, temperature, and confining pressure, it was considered that the load transfer method selected should correspond to the expected sample behavior. In this paper, the results of a series of compression and creep tests were presented, in which the effects of speciment shape and end conditions on the behavior of a frozen sand were systematically investigated and compared. (See also W80-01498) (Sims-ISWS)
W80-01514

STRAIN RATE EFFECT ON THE COMPRESSIVE STRENGTH OF FROZEN SAND,
National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
T. H. W. Baker.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 223-231, April 1979. 6 Fig, 3 Tab, 13 Ref.

Descriptors: *Frozen soils, *Sands, *Compressive strength, Laboratory tests, Frozen ground, Moisture content, Freezing, Physical properties, Mechanical properties, Loads(Forces), Deformation, Elastic deformation, Strain, Ice, Analytical techniques, *Strain rate.

Cylindrical specimens of fine Ottawa sand (A.S.T.M. designation C-109), compacted at the optimum moisture content and saturated before unidirectional freezing, have been tested in uniaxial compression at a cold room temperature of -5.5 C and strain rates between 0.0000001 and 0.01/s. Variation in the total moisture (ice) content influenced unconfined compressive strength. This was typical of frozen sands slightly oversaturated with ice. Specimens that expanded during freezing showed a reduction in unconfined compressive strength and strain to failure. The four platen types investigated did not significantly affect the value of the unconfined compressive strength or the strain to failure. The mode of failure at the lower strain rates was different for each platen type. Maraset compliant platens produced the most uniform deformation, with no speciment bulging. (See also W80-01498) (Sims-ISWS)
W80-01515

CYCLIC TRIAXIAL TESTS ON FROZEN SAND,

Michigan State Univ., East Lansing.
For primary bibliographic entry see Field 2C.
W80-01516

CREEP STRESS ANALYSIS OF FROZEN SOILS UNDER MULTIAXIAL STATES OF STRESS,
Bochum Univ. (Germany, F.R.). Dept. of Civil Engineering.
J. Klein, and H. L. Jessberger.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 353-365, April 1979. 12 Fig, 5 Ref.

Descriptors: *Frozen soils, *Creep, *Laboratory tests, *Analytical techniques, Deformation, Mechanical properties, Stress, Testing procedures, Methodology, Soil mechanics, Finite element analysis, Uniaxial compression tests.

Creep behavior of the so called Emscher-Marl was investigated in uniaxial compression tests under a temperature of -10C. Similar to the results of creep tests published elsewhere, it was shown that the secondary creep controls the deformation. In cases of stationary creep, the material behaves like a nonlinear elasto-viscous Maxwell fluid. Assuming no hydrostatic pressure effect, the power law applied to the uniaxial case can be transformed to multiaxial states of stress. For structures of frozen soil with a long-term deformation process, Norton's power relationship between stress and rate of steady flow leads to reasonable results. As a numerical solution, a finite-element computer program in connection with incremental procedure was developed for treatment of creep problems in ground-freezing technology. The calculation of a simply supported beam demonstrated the important influence of the high nonlinearity in stress and strain for frozen soils. (See also W80-01498) (Humphreys-ISWS)
W80-01523

STRENGTH ANALYSIS OF THE FROZEN-GROUND ENCLOSURE OF A LOW-TERMPERATURE STORAGE RESERVOIR FOR LIQUEFIED GASES,
All-Union Research Inst. for the Utilization of Gas in the Economy and for the Underground Storage of Oil, Oil Products and Liquefied Gases, Moscow, (USSR).
N. P. Ilyina, and Ye. M. Shafarenko.
In: Ground Freezing: Proceedings of the First International Symposium on Ground Freezing, Bochum (Germany), March 8-10, 1978. Engineering Geology, Vol 13, Nos 1-4, p 367-374, April 1979. 3 Fig, 2 Tab, 4 Ref.

Descriptors: *Frozen ground, *Underground storage, *Frozen soils, Mechanical properties, Sands, Youngs modulus, Analysis, Analytical techniques, Laboratory tests, Deformation, Strain, Strength, Bearing strength, Foreign research, Soil mechanics, *USSR, Liquified gases.

The geometrical dimensions of a frozen-ground enclosure for a low-temperature storage reservoir were determined from a static design on the assumption of a safe excavation of ground in digging the trench. Neglecting the combined work of the enclosure and surrounding thawing rock mass, the problem was reduced to the design of the frozen-ground shell, stressed along its outer contour by the thawing ground pressure. To estimate the tension of the wall of an enclosure it was sufficient to use the solution of the problem of a thick-walled tube subjected to ambient pressure. It is difficult to find a sufficiently simple analog for the problem of the bottom. The solution of the plate-bending problem locates the neutral line in the middle of the section when there are equal tensile and compressive stresses at the inner and the outer contour. If the combined work of the bottom of the section and the wall is taken into account, the neutral line shifts from the center of the bottom to the inner contour of the enclosure, i.e., the compressive stresses exceed the tensile ones, which is of particular importance for materials with different resistances to compression and tension. (See also W80-01498) (Humphreys-ISWS)
W80-01524

DESIGN OF TUNNEL SUPPORT SYSTEMS USING GROUND FREEZING,
Law Engineering Testing Co., McLean, VA.
For primary bibliographic entry see Field 2G.
W80-01525

GROUND CONSOLIDATION WITH LIQUID NITROGEN (LN2),
Linde A.G., Hollriegelskreuth (Germany, F.R.). Technical Gases Div.
For primary bibliographic entry see Field 2C.
W80-01531

USES AND LIMITATIONS OF GROUND FREEZING WITH LIQUID NITROGEN,
Deilmann-Haniel G.m.b.H., Dortmund (Germany, F.R.).
For primary bibliographic entry see Field 2C.
W80-01532

NATURAL FROST IN IMPROVEMENT OF CONSTRUCTION PROPERTIES OF GROUND IN HYDROENGINEERING AND INDUSTRIAL AND CIVILIAN CONSTRUCTION,
Akademiya Nauk SSSR, Yakutsk. Inst. Merzuotovedeniya.
For primary bibliographic entry see Field 2C.
W80-01533

FROST PROTECTION OF RAILWAY LINES,
Norwegian State Railways, Oslo (Norway).
For primary bibliographic entry see Field 2C.
W80-01534

JOINTING OF TWO TUNNEL SHIELDS USING ARTIFICIAL UNDERGROUND FREEZING,
Seiken Co., Ltd. Osaka (Japan).
For primary bibliographic entry see Field 2G.
W80-01535

CONVERSION OF ABANDONED COLLIERIES IN SOUTHERN BELGIUM INTO LOW-PRESSURE GAS STORAGE UNITS, WITH DESCRIPTION OF SPECIAL PLUGGING OF THE VARIOUS SHAFTS,
N. V. Foraky SA., Brussels (Belgium).
For primary bibliographic entry see Field 2G.
W80-01536

APPLICATION OF THE GROUND-FREEZING METHOD TO PENETRATE A SEQUENCE OF WATER-BEARING AND DRY FORMATIONS--THREE CONSTRUCTION CASES,
Thyssen Schachtbau G.m.b.H., Mulheim an der Ruhr (Germany, F.R.).
For primary bibliographic entry see Field 2G.
W80-01537

8I. Fisheries Engineering

EVALUATION OF WATER QUALITY MANAGEMENT PROCEDURES USED ON MISSISSIPPI CATFISH FARMS,
Mississippi State Univ., Mississippi State. Dept. of Agricultural and Biological Engineering.
J. C. McWhorter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80116577, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University, October 1979. 31 p 7 Fig, 4 Tab, 11 Ref, Append. OWRT A-122-MISS (1). 14-34-0001-9026.

Descriptors: *Fish farming, *Catfish, *Dissolved oxygen, Aeration, Water quality, Evaluation, Energy, *Humphreys County(MS), Lower Mississippi Delta(MS), Aeration devices.

The purpose of this study was to observe dissolved oxygen in catfish ponds and to relate energy requirements of several aeration systems to dissolved oxygen concentrations. Six ponds in Humphreys County, Mississippi, ranging from 7-30 surface acres, were studied during the months of June, July, and August. Oxygen concentrations were observed daily, in the morning and evening. The BOD and COD were determined on seven occasions at intervals of one to two weeks. Records were kept regarding the operation of 'pump-spray' aerators and lowering the water level and replacing with well water. Morning oxygen levels averaged about 6 mg/1 while afternoon average were generally around 9 mg/1. No fish losses were attributed to oxygen deficits; however, some losses occurred as a result of parasites. BOD values ranged from lows of near 3 and 4 to highs of 9 and 10 mg/1. There were several highs in excess of 11 mg/1. COD values ranged from 20 to 100 mg/1. It appeared that each pond tened to retain its BOD and COD characteristics during the study period; however, there was a trend of increasing values as the study period progressed into late August. Some water was added to all ponds and drained from four. The average maximum energy use for one of two ponds using spray aeration was 17 horsepower hours per day per surface acre. Aerated ponds were subjected to more intensive production demands.
W80-01382

EFFECTS OF SOLAR RADIATION ON THE DYNAMICS OF DISSOLVED OXYGEN IN CHANNEL CATFISH PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
R. P. Romaire, and C. E. Boyd.
Transactions of the American Fisheries Society, Vol 108, No 5, p 473-478, September 1979. 2 Fig, 4 Tab, 15 Ref. OWRT A-066-ALA (4).

Descriptors: *Dissolved oxygen, *Solar radiation, *Model studies, Mathematical models, Oxygen, Radiation, Effects, Chloropyll, Secchi disks, Algae, Phytoplankton, Fish, Catfish, Channel catfish, Ponds, Aquiculture, Sampling, On-site investigations.

The day time increase in dissolved oxygen (DO) concentration of pond waters may be estimated from solar radiation, chlorophyll a concentration, and percentage 02 saturation at dawn (coefficient of multiple determination, R sq = 0.83), or from solar radiation, Secchi disk visibility, and percentage 02 saturation at dawn (R sq = 0.80). A computer simulation model for predicting the effects of cloudy weather (low solar radiation) on DO depletion was developed for channel catfish ponds. The model incorporates the equation for estimating daytime DO increase from solar radiation and Secchi disk visibility with components for estimating the nighttime decline in DO from respiration by the plankton, fish, and benthic communities, and the gains or losses from diffusion. Results from the study demonstrated that the combination of dense plankton blooms and low levels of light intensity were closedly related to low concentrations of DO. (Sims-ISWS)
W80-01583

9. MANPOWER, GRANTS AND FACILITIES

9B. Education (In-House)

SURVEY OF GAMMA-EMITTING ARTIFICIAL RADIONUCLIDES IN FISH FROM FINNISH WATERS,
Abo Akademi, Turku (Finland). Inst. of Biology.
For primary bibliographic entry see Field 5A.
W80-01325

9C. Research Facilities

FOOD INTAKE, GROWTH, FOOD CONVERSION, AND BODY COMPOSITION OF CATFISH EXPOSED TO DIFFERENT SALINITIES,
Bangalore Univ. (India). Dept. of Zoology.

For primary bibliographic entry see Field 5A.
W80-01326

SEDATION OF WARM-WATER FISH SPECIES IN AQUACULTURE RESEARCH,
Stirling Univ. (Scotland) Unit of Aquatic Pathobiology.
For primary bibliographic entry see Field 5A.
W80-01327

THE EFFECTS OF TEMPERATURE ON THE RESPIRATION AND PRODUCTION OF THE FRESHWATER NEMATODE ANONCHUS SP.,
Lancaster Univ., Bailrigg (England). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-01328

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

BIBLIOGRAPHY OF GEOLOGY AND HYDROLOGY, EASTERN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
A. F. Wright.
Geological Survey Water-Resources Investigations 79-76, March 1979. 170 p, 1 Fig.

Descriptors: *Bibliographies, *Geology, *Hydrology, *Natural resources, Oil, Natural gas, Potash, Coals, Chemistry, *Eastern New Mexico, *High Plains.

The High Plains of the eastern New Mexico region are recognized as an abundant and varied source of natural resources. The bibliography of over 1,900 references concerned with geology, hydrology, chemistry, and geography has been compiled to assist physical science researchers in their study of this region. (Kosco-USGS)
W80-01591

10D. Specialized Information Center Services

FUNCTIONAL ANALYSIS OF THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER (WRSIC) MISSION,
CENTEC Corp., Reston, VA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-111842, Price codes: A04 in paper copy, A01 in microfiche.

Descriptors: *Documentation, Research, Abstracts, Libraries, Colleges, Universities, *Functional Analysis, Systems Approach, *Water Resources Scientific Information Center.

This document is intended to be used as a framework for communicating present WRSIC capabilities and to guide efforts to identify important new requirements that have arisen due to recent reorganizations and shifts in emphasis affecting WRSIC activities. In particular, the analysis has focused on the relationship of WRSIC to technology transfer and other activities of the Office of Water Research and Technology. Information presented is the result of a modern systems approach that structurally defines the WRSIC mission in terms of detailed functions. Two of the major tools utilized are 'Functional Analysis' and Hierarchy plus Input-Process-Output (HIPO). These tools and their application to the WRSIC mission are described. A graphic overview is presented of the WRSIC information system which was constructed from the HIPO analysis. Following the documentation of the current system, a recommendation for improving the ability of WRSIC to satisfy present and near-future requirements is presented. The plan shows what requirements must be satisfied and suggests a methodology for achievement. Also included is a glossary of organizational and information terms.
W80-01201

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